TROPICAL DISEASES BUREAU.

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DISEASES DUE TO PROTOZOAN PARASITES.

NATTAN-LARRIER (L.). **Essais de transmission héréditaire de la Dourine.** [Attempts at the Hereditary Transmission of Dourine.] —*Bull. Soc. Path. Exot.* 1921. May 11. Vol. 14. No. 5. pp. 273–277.*

The trypanosome of dourine is known to have the power of traversing mucous membranes with ease. It was consequently decided to ascertain whether in any circumstances it could traverse the placenta in pregnant females.

In mares, infection with *T. equiperdum* frequently produces abortion, but this phenomenon was not observed in any pregnant female rats or mice used as reservoirs during the author's experiments.

In the course of these experiments female rats and mice were inoculated intraperitoneally with *T. equiperdum*, and periodic subsequent blood examination showed them to be infected. The young from such mothers were observed carefully and blood smears were examined, but in every case with negative findings. Further experiments are quoted in which emulsions of triturated organs—spleen and liver—and blood from such young rats and mice were injected intraperitoneally into other rats and mice. In no case did a trypanosome infection follow. Incidentally it might be noted that although there is no hereditary transmission of trypanosome infection, it is nevertheless quite common for one or more foetuses of a litter to be born dead. Also trypanosomiasis was never seen to develop subsequently in young born of an infected mother.

It might be suggested that they were born with some degree of immunity, but this was disproved by inoculating such young with virulent blood; in all cases they developed and succumbed to *T. equiperdum* infection. Furthermore, it was similarly proved that no immunity was developed in virtue of sucking an infected female—the milk confers no immunity.

* Abstracted by Mr. S. C. J. Bennett, B.Sc., M.R.C.V.S.

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MARSHALL (Claude H.). **A New Method of Treatment of Trypanosomiasis.**—*Trans. Roy. Soc. Trop. Med. & Hyg.* 1921. Mar. 18 & May 20. Vol. 15. Nos. 1 & 2. pp. 10–34.

In this paper Marshall describes "a new method of treatment" of human trypanosomiasis originated by himself and VASSALLO (S. M.) of the Uganda Medical Service.*

In the treatment of human sleeping sickness experience shows that one dose of salvarsan, neosalvarsan, or atoxyl is sufficient to sterilize the blood stream, but within a variable period the symptoms reappear and the disease progresses to a fatal termination. The relapse would appear to be due either to the possibility that (1) the trypanosome assumes a resistant form and becomes atoxyl-"fast," or (2) some of the parasites are protected from the action of the drug by assuming a secluded position in the central nervous system. The author quotes four cases which would appear to lend support to the latter assumption; living trypanosomes were discoverable in the cerebro-spinal fluid in these cases after sterilization of the blood stream and lymphatic glands. It was further claimed that in fatal cases the meninges of the brain were greatly thickened, due, it would appear, to the action of the trypanosome in the central nervous system. This thickening of the membranes would cause the connection between the blood stream and cerebro-spinal fluid through the choroid plexus to be occluded quite early in the disease, so that drugs circulating in the blood stream could not enter the spinal fluid to act upon the trypanosomes therein. The parasites would subsequently be able to reinfect the blood stream. Before the cerebro-spinal fluid has been invaded it is quite feasible that injections of arsenic and other drugs are capable of curing the patient, but once the central nervous system is invaded intravenous medication is useless except to deal with such parasites as subsequently reappear in the blood stream from the lymphatic system.

In pursuance of this hypothesis the author in 1918 attempted treatment by injection of neokharsivan intravenously, and three days later a minute dose of the drug was injected into the spinal canal. The patient, however, died on the following day. As this form of treatment had failed, the next case was given an intravenous injection of the drug, and three hours later 2 oz. of blood were withdrawn and allowed to clot. Twenty minims of clear serum were then injected into the spinal canal after a corresponding amount of spinal fluid had been drawn off by lumbar puncture. The case (a woman) was one of well-marked sleeping sickness, with typical enlarged cervical glands. Blood was examined at intervals of three months, and 27 months after treatment the patient was quite well; the blood and cerebro-spinal fluid were then negative, and the swelling of the neck glands had completely disappeared soon after the injection and had not reappeared. In all, 54 cases were treated in this manner, and of these, 31 had undergone treatment over six months previously. One of these died under chloroform. Of the 30 cases that had been treated with serum once only 22 cases still remained alive and well, *i.e.*, 73 per cent. Thirteen of these cases had undergone treatment over a year previously and nine of these (69 per cent.) were still alive and well. One dog infected with *T. gambiense* was treated as a control to see if an intravenous injection

* Dr. Andrew BALFOUR suggested in 1909 the intrathecal injection of immune serum. [*Sleeping Sickness Bulletin*, Vol. 1, p. 163.]

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of neokharsivan can alone cure the disease, but the animal had to be shot about a month later as it was hopelessly ill. All the cases said to have been cured were examined in December 1920, and the blood and cerebro-spinal fluid gave negative results on examination in all of them. After treatment the glandular swellings also invariably disappeared completely. Of the six patients who died two disappeared during a period of famine, and one of these is stated to have died of starvation ; two died of intercurrent disease, and two apparently died of sleeping sickness ; these were very advanced cases of the disease. Thus one case remained quite well for over 27 months, another for 24 months, and seven for over a year after treatment with a single dose of serum.

It would appear that the beneficial results were attributable to the action of a trypanolytic antibody normally found in the blood during the reaction to the parasitic invasion. It is not feasible that the minute quantity of the drug held in the small quantity of serum injected into the spinal canal would be powerful enough to kill off the trypanosomes. In support of this view it is stated that in several cases the patient received no intravenous injection, but simply a dose of serum expressed from blood that had been drawn off for as long as three days. The first case treated, when examined six months later, appeared to have gone on well, and no trypanosomes were discoverable in his blood or spinal fluid. VASSALLO is now trying the effect of intra-spinal injection of serum from a previously treated case.

One European exhibited at the meeting showed signs of the disease on July 30, 1920, and when examined a month later his blood was found to be swarming with trypanosomes. He was given 0·9 gm. of neokharsivan intravenously and 12 cc. of serum into the spinal canal. He showed a very severe reaction for several days and then made an uninterrupted recovery. However, six weeks after the serum injection, while nothing abnormal could be found in the blood, sub-inoculation into two rats and a monkey resulted in one rat showing trypanosomes 28 days later. The monkey became very sick, but it did not die, and no trypanosomes were found in its blood. Again, 21 days later a careful search showed only one degenerated trypanosome in the blood. Sub-inoculations into guinea pigs were negative. The author considers that the presence of such degenerated trypanosomes was merely a feature of the normal process of cure by this method. Thirty days later the cerebro-spinal fluid was examined by staining and inoculation into rats and mice, with negative results. The presumed cure of this patient would therefore not be due to the trypanocidal action of the initial dose of the drug, inasmuch as trypanosomes could be discovered in the blood after treatment. Subsequently this patient showed an excellent clinical history, and examination of the blood failed to disclose any trypanosomes. The injection into the spinal canal would therefore probably have dealt with that focus of infection, while the continued formation of trypanolysins in the blood gradually destroyed the parasites in the blood stream.

The two most advanced cases did not prove amenable to treatment, and in advanced cases no cerebro-spinal fluid could be obtained by lumbar puncture. It would seem that this condition was due to the thickening of the membranes, resulting in occlusion of the foramen of Majendie. If the authors' theories are correct there appears to be no reason why animal serum should not be used for treatment, and it is suggested that the line of treatment might well be applied to animals. Further

work is being carried on by VASSALLO and the author on these questions. "The problem of trypanosome infection is the same whether applied to human beings or other animals, and experiments on the treatment of each dovetail into one another, so that the co-operation of a veterinary officer in future work is extremely desirable."

In the discussion which followed, HALLIBURTON (W. D.) gave a succinct account of what he regarded as the normal formation of the cerebro-spinal fluid and its normal function. The cerebro-spinal fluid, it was stated, is a secretion, not a leakage fluid like lymph is from the ordinary blood stream. The choroid plexus, which MOTT has called the choroid gland, plays a part which is something analogous to that of a secreting gland such as the salivary gland, but in this case the blood vessels are inside and are coated over by cubical cells which are true secreting cells and show histological changes similar to those which can be detected in various stages of secretion in the salivary glands. The blood leaks from the capillaries and gives rise to lymph, and then the cells take up from the lymph the materials which they want and pour their secretion into the cerebro-spinal spaces. This secretion, as with other secretions, is of constant composition, for otherwise any error in composition would produce serious effects upon the very sensitive nerve cells. Thus the cells which secrete the fluid form a barrier to prevent harmful materials entering the cerebro-spinal fluid. There are only one or two very volatile materials which are capable of traversing the choroid cells, and of these alcohol is one, but metallic poisons are kept back even in disease. Therefore the only method of attacking parasites, such as the spirochaete of syphilis or the trypanosome of sleeping sickness, which have gained access to the spinal canal is to inject the drug employed not into the blood stream, but directly into the cerebro-spinal fluid. However, drugs injected in this manner produce severe effects upon the very sensitive nerve cells, but in the method described by Marshall and VASSALLO the material injected appears to be fatal to the parasite but not fatal to the host.

HALLIBURTON thus discredits the authors' hypothesis that the action of the trypanosome in the central nervous system is to cause such thickening of the membranes that connection between the blood stream and cerebro-spinal fluid through the choroid plexus is occluded quite early in the disease. The choroidal cells, in fact, remain quite healthy. Materials introduced artificially into the cerebro-spinal canal do not leave by the lymph channels, for if methylene blue, for example, is introduced into the spinal canal, no trace of blue passes into the lymph stream. The fluid, which is being continually formed, does not find an exit by the nerve or other lymphatics, but through the microscopic arachnoid villi, which project into the venous sinuses mainly at the base of the brain. A few seconds, therefore, after the injection of methylene blue, although it cannot be discovered in the lymph, it can be found in the blood, and in a few minutes in the urine. Communication is not via the lymph stream, but by the blood stream and the arachnoid villi.

The method of treatment was criticized adversely by MANSON-BAHR (P.) and LOW (G. C.). MANSON-BAHR doubted whether invasion of the cerebro-spinal fluid by trypanosomes was necessary in order to produce the sleeping sickness state; he mentioned a case under his care in which the cerebro-spinal fluid had consistently given negative results on testing and was then in a dying state, five years after the original infection. Another case had received Marshall's

treatment, without success. There were on record about 16 cases in Europeans of undoubted recoveries from *T. gambiense* infection. The idea that the trypanosomes are only present in the cerebro-spinal fluid in sleeping sickness is begging the question, according to Low. Moreover, there is no proof that the antibody cannot get into the cerebro-spinal fluid. In syphilitic conditions such as general paralysis of the insane and locomotor ataxy a similar theory to Dr. Marshall's had already been put forward, but salvarsanized serum injected into the spinal canal and even into the lateral ventricles produced absolutely negative results.

The meeting, however, unanimously decided to give the workers every encouragement to obtain means for exploiting their method of treatment.

CROVERI. *Trypanosoma theileri*, **varietas** *somalensis*, **chez les bovidés somaliens, considéré par rapport à la peste bovine et aux séro-vaccinations anti-pesteuses.** [*Trypanosoma theileri* var. *somalensis* in Somaliland Cattle considered in Relation to Rinderpest and Anti-Rinderpest Vaccination.]—*Rev. Path. Comp.* 1920. July. Vol. 20. No. 170. p. 183.

Croverie describes a trypanosome in the blood of cattle in Italian Somaliland which would appear to belong to the type *T. theileri* according to its general characteristics, but the constant presence of a few secondary characteristics would seem sufficient to authorize the creation of a new variety to include this trypanosome. The trypanosome possesses extreme motility, length 40–70μ, breadth 3–7μ, markedly pointed extremities, cytoplasm staining irregularly of a deep blue colour, generally granular towards the posterior extremity; nucleus usually rounded, stained chromatin red, placed in the centre of the body where it does not stretch across the whole breadth; nucleolus fairly large, well stained, and placed at some distance from the posterior extremity, between this extremity and the nucleus; flagellum long and well stained, united to the protoplasmic body by means of a well-developed undulating membrane; common occurrence of degenerated forms. Contrary to what is observed in the pathogenic trypanosomes, this variety is never seen in the lymphatic glands. The trypanosome is observed quite commonly in healthy cattle used for the manufacture of rinderpest vaccine. It shows no virulence, but it would seem that it becomes pathogenic during the course of rinderpest infection and modifies appreciably the characters of the disease. The important question was raised, what would be the ultimate action of the parasite upon the properties of the serum or vaccine. According to the author it appears to have no influence.

MESNIL (F.). **Variété des voies d'accès des parasites sanguicoles à leurs hôtes.** [The Different Modes by means of which Blood Parasites enter into their Hosts.]—*Bull. Soc. Path. Exot.* 1921. June 8. Vol. 14. No. 6. pp. 310–315.

The optimum method of transmission for a blood parasite is brought about when it is withdrawn from the blood by an insect and is reintroduced by it into suitable blood. Leaving aside the cases where the insect plays but a mechanical rôle in much the same manner as a syringe needle, cases of trypanosome transmission by means of tsetse fly take first consideration. In the very simple case of

T. cazalboui development takes place only in the proboscis, while with *T. brucei* and *T. gambiense* the development leaves the proboscis and is continued in the stomach and then in the salivary glands, to return again to the proboscis; the development of *T. dimorphon* [*congolnsee*] is intermediate in character, this trypanosome returning to the proboscis after development in the stomach. In all these cases, however, the development has certain points in common: (1) the flagellate after leaving the blood passes through a crithidial stage and again returns into a particular trypanosome form ,called the "metacyclic form" by BRUMPT, and in this form it can be reinoculated into the vertebrate host, and (2) the same physiological fluid, the saliva, plays a capital part in all the cases.

The malarial parasites of man display the same kind of adaptability, complicated on account of the different zoological position of the parasites. After having been taken from human blood in the form of gametocytes the parasite undergoes a complete sporogonous sexual development in the mosquito, resulting in the formation of sporozoites, which pass into the salivary glands and thence can be reinoculated into man. The same phenomena appear to occur in the different spirochaetoses and their tick vectors, typhus and the louse, and yellow fever and Stegomyia.

In what may be called a second type of transmission the parasite, after withdrawal from the vertebrate blood, is not reintroduced into this medium. On the other hand, it is transported by the insect at the moment of biting, but only on to the surface of the skin. The example of the filarial parasites is interesting in this respect. The microfilariae (*bancrofti* of man and *immitis* of the dog) taken up with the blood develop in the mosquito up to a certain stage and then, after becoming liberated in the body cavity, they are directed into the lower lip of the mosquito, which appears to be a sort of predilection seat for them, and they accumulate in this situation. The lower lip, however, does not form part of the proboscis, but is a sort of gutter-like sheath which becomes curved into U-shaped form when the stylets of the proboscis penetrate the skin, and the extremities of this lip (the labellae) are applied to the skin. The lower lip therefore constitutes a closed path for the filariae, but after having been thrown forward at the time when the lip is curved they are dashed against a thin membrane (the so-called Dutton's membrane), situated between the two labellae. They rupture this membrane, and are thus found at the surface of the skin. FULLEBORN showed that the young filariae crawl about on the skin and are capable of traversing healthy skin in the same manner as the Ankylostoma or Anguillula larvae, especially when the skin is moist, and thus infect a new individual.

With some other parasites development and concentration takes place not in the anterior part of the insect's body, but in the posterior portion of the intestine, and the parasites are eliminated with the excreta—examples, fleas and the human plague organism, fleas and the rat trypanosome (*T. lewisi*), and Hemiptera of the genus *Triatoma* and *Schizotrypanum cruzi*, the causal organism of Chagas's disease in the human subject. These insects defaecate frequently in the course of their blood-sucking operations, which last a considerable time. The parasites from the rectum are thus deposited on the surface of the skin, and in a certain number of cases at least they seem to be capable of traversing it, perhaps through the breaches in continuity

determined either by the insect bite or by scratching. In other cases this penetration can only be accomplished when the virus is transported on to the surface of mucous membranes, as would appear to take place in Chagas's disease. Here return of the parasite to the salivary glands would appear to be accidental, and the normal mode of inoculation would seem to be by the passage of the metacyclic trypanosome developed in the rectum of the bug through the mucous membranes. During the night it is known that these insects crawl over the faces of sleepers and are thus capable of infecting the facial mucous membranes.

It was formerly held that the louse acted as transmitter of the spirochaetes of relapsing fever, but it was found impossible to transmit the disease by means of its bites. NICOLLE (Ch.) and his colleagues found that the virus became established rapidly in the body cavity of the louse and remained bottled up in this situation. Neither the anterior nor posterior part of the digestive tract disclosed parasites, and in order to account for the transmission of the spirochaete from the louse to man, NICOLLE suggested, as the only possibility, that the louse was crushed on the body surface, and this liberated the spirochaetes and enabled them, therefore, to traverse the skin through scratches or the mucous membranes.

In a third class the blood parasite enters the vertebrate host via the digestive tract, and the first example of this kind was that of the Leucocytozoon of the rat. The life-cycle of this protozoon was completely traced by MILLER in 1909. The haemogregarine parasite inhabited the rat leucocytes, and accomplished its sporogonous development in a small acarus commonly found on rats, *Loelaps echidninus*. The sporozoites developed, however, were not liberated from the ripe spores, and the rat became infected only after eating the acari.

The development of the rat trypanosome in the rat flea has been carefully studied by MINCHIN and THOMSON, but STRICKLAND has also shown that the rat may become infected by eating infected fleas. Subsequently NÖLLER and WENYON suggested that rats became infected chiefly by licking the faeces deposited by the fleas on their skin—a mode of infection that would approach that which was discussed under the second class of transmission. It remains to be seen which is the more important natural form of transmission.

The examples of the rat leucocytozoon and *T. lewisi* represent, it would seem, a transition towards what is seen in the case of certain Coccidia which have dual hosts, as, for example, the coccidian parasite which undergoes its sexual reproduction and sporogony within certain Cephalopod hosts (octopuses and cuttlefish) and undergoes schizogony in crabs. The Cephalopod host becomes infected by eating the crab and the crab becomes infected by ingesting spores from the Cephalopod (LEGER and DUBOSCQ).

Passing by other examples such as those of the piroplasms, which are complicated by hereditary infection in the invertebrate, the importance of the mode of entry upon the subsequent development of the parasite may be illustrated by another example, viz., that of *Stephanurus dentatus* of the pig, which is not a blood parasite. In much the same way as ankylostome and anguillulid worms it is capable of penetration via the skin as well as by the mouth. BERNARD and BAUCHE found that the seat of the parasite in the pig and the disease provoked differed according to the port of

entry. If penetration took place through the skin the parasites became established around the kidneys and ureters and a chronic disease was set up, with rapid excretion of worm eggs. If, on the other hand, infection took place by way of the mouth, the parasites became established in the liver and caused a severe type of disease with cirrhosis of the liver, and the eggs could not be eliminated. In Annam, French Indo-China, the first-named type of the disease is by far the most frequent, indicating that the common mode of infection is through the skin.

Mesnil then briefly discusses the subject of insect transmission from an historical and from a phylogenetic point of view. Historically he traces our conceptions of this phenomenon from the time of MANSON'S discovery in 1877 of the development of the filaria in the mosquito, and the discovery by LOW and JAMES of the true method of transmission of this parasite. Following upon the lead given by MANSON'S researches, ROSS was inspired to work out the development of the malarial parasite in the mosquito and discovered the important fact that it was the mosquito that transported the parasite back into the blood. Meanwhile LOOSS'S researches on intestinal parasites, such as ankylostomes, anguillulas, also accustomed us to this method of active cutaneous penetration. But the more recent researches of LEIPER have shown that one would be in error to generalize too readily, for the guinea-worm, which, moreover, is not an intestinal parasite, is absorbed via the mouth with a second host—a small copepod crustacean.

Having in mind the examples of various viruses, such as those of yellow fever, typhus, etc., the notion that blood parasites were reinoculated by the bite of the insect was also a little quickly generalized. MILLER'S discovery perhaps did not attract sufficient attention. It was surprising to learn that all trypanosomes were not inoculated by the proboscis of the invertebrate, and this new notion subsequently had to be extended to other diseases such as relapsing fever.

From a phylogenetic point of view it is interesting to study, for example, the origin of the blood trypanosomes. Inasmuch as most of them are parasitic in both vertebrate and invertebrate, it would be of value to ascertain the primitive host. The theory first emitted was that of LOUIS LÉGER, which has since been upheld by several French writers, and is based upon the observation that in insects, both biting and non-biting, several representatives of the large family *Trypanosomidae*, and in particular the types *Leptomonas* and *Crithidia*, which are discoverable in the life-cycle of the trypanosome, are to be found. It would therefore appear that the invertebrate is the primitive host. According to MINCHIN, on the contrary, the vertebrate host would be accountable and, moreover, the trypanosomes might be derived from intestinal forms. When this theory was propounded the only types of intestinal trypanosomes known were comparable to the blood flagellates or so-called trypanoplasms of fishes, which are markedly different from the ordinary pathogenic trypanosomes.

Mesnil believes that recently recorded facts bearing upon the entrance of certain trypanosomes by way of the digestive tract of the vertebrate lend strong support to MINCHIN'S hypothesis. This channel of entry is regarded as imperfect in comparison with inoculation into the blood stream, a view which makes it reasonable to conclude that it is

the more primitive method. Moreover, there have been found in the intestinal tract of a number of invertebrates flagellates known as Leptomonas, which are precisely ancestral forms of trypanosomes. It is also known that these Leptomonas, together with other flagellates which normally inhabit the intestine, are capable of passing into the blood stream, and the frequency with which these transmissions have been recorded during the last few years tends towards the belief that the phenomenon is applicable not only to pathological processes.

Further, it may be therefore said that if one desires to undertake a classification of the genus *Trypanosoma* by dismembering it, for example, into sub-genera, one must above all else base this division upon morphological characters. In this way one is forcibly struck with the parallelism existing between the grouping of the trypanosome species and the subdivision of vertebrates into classes. It is therefore easy to conceive a sub-genus for the fish trypanosomes, another for the trypanosomes of lizards and reptiles, another for avian trypanosomes, two at least for mammalian trypanosomes (one for the so-called non-pathogenic *lewisi* type, and another for the *brucei, gambiense*, etc., types) without counting the trypanosomes of the *Schizotrypanum* type. Thus in the same class of vertebrates, in spite of the common appearance of the infesting trypanosomes the vectors may belong to quite different classes of invertebrates. It is difficult to imagine that there simply lies therein nothing but convergence. It is agreed that no argument is entirely convincing, but the sum total of them all tends to incline one more and more towards the view that the vertebrate is the primitive host.

SERGENT (Etienne & Edmond). **Étude éxpérimentale du Paludisme. Paludisme des Oiseaux** (*Plasmodium relictum*). [Experimental Study on Malaria—Bird Malaria (*P. relictum*).]—*Bull. Soc. Path. Exot.* 1921. Feb. 9. Vol. 14. No. 2. pp. 72–77.*

These experiments were designed with a view to estimating the value of quinine as a preventive or curative of malaria. It was obviously impossible to carry out the tests on the human subject, so that bird malaria was chosen owing to the close relation of the two malarial parasites. Canaries bred in captivity in insect-proof cages were selected as the most convenient and plentiful subjects for experiment. These birds are very susceptible to *Plasmodium relictum* infection in that an intraperitoneal dose of one drop of infected blood will within from three to ten days produce a blood infection with very numerous parasites (80 parasites per field of the oil-immersion objective in an ordinary blood smear). Death is produced in about 30 per cent. of cases.

A preliminary experiment showed that quinine hydrochloride was of curative value, as a quantity of 0,003 gm., divided into three doses, given on the first day the parasites appeared in the blood caused them to disappear within 48 hours, whilst in control birds the infection remained intense for another five days.

To determine the prophylactic value of quinine, birds were inoculated with virulent blood and simultaneously with 0·7 milligrammes of hydrochloride of quinine subcutaneously, a similar dose being given daily afterwards. No symptoms were presented and no

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parasites appeared in the blood so long as the daily dose of quinine was injected, while the control birds all developed typical symptoms with blood invasion. It was found necessary to give the dose of quinine every day for at least a month, but after this period every second day was sufficient. In many cases, even after prolonged treatment with quinine, a bird which had throughout shown no symptoms would become ill as soon as dosing with quinine was discontinued. The parasites must thus remain latent in the body,—a fact which was proved by the infectiousness of the blood of such birds for clean controls.

Additional doses of virulent blood were found to be harmless to birds receiving quinine treatment.

One may conclude from the above that prophylactic doses of quinine will at least ensure the survival of subjects exposed to infection and—a most important feature if it be applicable to human malaria—the acute phase of the disease will be eliminated.

Further experiments proved that other methods of dosing with quinine are useless. A single large dose given either before, at the time of, or soon after the virulent inoculation did not in any case inhibit acute symptoms, although a single large dose given within 24 hours of inoculation delayed the appearance of symptoms by from two to four days. Furthermore, repeated small daily doses are of no value if discontinued after a short while.

The authors conclude that quinine dosage given beforehand in anticipation of infection is useless, as are also a few doses, even if of considerable size, given after infection. The only system whereby the acute stage and symptoms may be suppressed is to give daily small doses uninterruptedly after the subject has been exposed to infection. [No mention of any time limit is made.—S.C.J.B.]

The quinine treatment is not only of value to the subject so treated, but is beneficial to others in that the virulence of the malarial parasite is diminished. This was proved by taking 18 canaries, 8 of which were treated with quinine and 10 not treated after virulent inoculation. The infectivity of the blood of all these birds was tested on mosquitoes, and other birds at intervals of one, two, four and six months. Of the eight birds treated with quinine two were non-infective, while the blood from the six others produced a mild infection in test subjects, the virulence only being restored to the normal after two or three passages. In the case of the control birds, even though they survived and showed no symptoms, the virulence of the parasites in their blood was up to the normal standard.

A single case is quoted of a sudden resistance to quinine on the part of a parasite in a treated bird. This bird had been infected with *Plasmodium relictum* and had been receiving daily doses of quinine for a period of nine months, showing no symptoms meanwhile. Suddenly parasites appeared in the blood and remained in spite of quinine treatment. Blood from this bird was virulent for other birds, which developed acute symptoms in spite of quinine treatment. After two passages, however, the parasite resumed its normal character and susceptibility to quinine.

Many other drugs were employed in similar experiments, but none of them gave evidence of possessing any curative or preventive qualities; they were marrubium, salicine, colloidal sulphur, emetin, arsenobenzol, cinnamon essence.

Vaccination experiments were attempted on a large scale, tests being performed on the following lines :—

1. Unnatural mode of infection—injection of virulent blood per rectum and intracutaneous inoculation of glands containing sporozoites.

2. Attempted production of a hyper-immune serum from non-susceptible animals (mice, pigeons, guinea-pigs, bengali), both with virulent blood and extracts of infected *Culex* mosquitos.

3. By modification of the normal malarial parasite by heat, ether, sodium fluoride, contact with old infected blood and conservation on NNN medium for some days.

4. By inoculation of sporozoites modified by heat, dilution, " ageing " in salivary glands and *in vitro*.

5. By injection of " immature " virus—immature zygotes from insects, and blood drawn from naturally infected birds during the period of incubation.

The results of these vaccination experiments were negative with the two following exceptions :—

1. Sporozoites " aged " *in vitro* (12–48 hours) produced immediate tolerance in 29·5 per cent. of cases.

2. *Plasmodium* parasites drawn from infected birds during the period of incubation produced tolerance in 21·3 per cent. of cases.

In the course of these experiments 965 control birds were used, only seven of which were normally resistant to *Plasmodium* injection.

Laveran, M.—*ibid* p. 78—in a brief discussion admits the interest of the above researches, but deprecates the use of the word " malaria." He says that the so-called bird-malaria, being caused by a different parasite from that causing human malaria, is not to be taken as a guide to the control of the latter disease without reserve.

Cauchemez (L.). **Fréquence des amibes iodophiles chez le porc, en France.** [The Frequency of Amoebae exhibiting an Affinity for Iodine in the Pig in France.]—*Bull. Soc. Path. Exot.* 1921. June 8. Vol. 14. No. 6. pp. 321–322. With 1 text fig.

Amoebae showing an affinity for iodine were first found by Wenyon in human stools in 1915. They were at first considered by Brug (S. L.) in 1919 to be identical with *Entamoeba williamsi*, Prowazek, 1911, but a little later Dobell identified them with *E. bütschli*, Prowazek, 1912. Brumpt believes that Wenyon's amoebae are not identifiable with Prowazek's amoebae, and proposes to call them *Iodamoeba wenyoni*, Brumpt, 1921.

In 1920 Connor discovered these amoebae in the pig at Funafuti, Ellice Islands (*Med. Jl. Australia*, 1920, Oct. 2, Vol. 2, No. 14, p. 337). In April and May 1921 Cauchemez ascertained the presence of these amoebae and their cysts in the faeces of eight out of 100 pigs, from six to eight months old, slaughtered in Paris. The parasites were plainly visible when examined in the fresh state, but their characters were brought out clearly by the addition of Lugol's solution, which increased their refractility and showed their affinity for iodine. After fixation in Bouin's solution and staining with iron haematoxylin two forms of parasite were seen, viz.: (1) Circular or oblong vacuolated vegetative forms having no membrane, containing a nucleus with a large karyosome, which exhibited a marked iron affinity and were comparable to the vegetative forms found in man; and, (2) circular or oblong vacuolated cysts with a double contour showing but slight affinity

for iron; their nucleus contained a spherical mass staining deeply with iron and a crescentic structure less deeply stained. The stained elements were considered by BRUMPT identical with *Iodamoeba wenyoni*.

More careful search for these organisms persuaded the author that they could be discovered in from 50 to 60 per cent. of samples of faeces taken from the pig. The percentage of cases of human infection estimated by WENYON was only 1 per cent. The author therefore concludes that *Iodamoeba wenyoni* is ordinarily a protozoan parasite of the pig in much the same degree as *Balantidium coli*. Like this parasite, however, it is capable in exceptional circumstances of adapting itself to living within the human body; the pig would therefore constitute the primary reservoir of the parasite.

CARINI (A.). **Sur un Leucocytozoon d'une Chouette du Brésil.** [A Leucocytozoon of a Screech-Owl in Brazil.]—*Bull. Soc. Path. Exot.* 1920. July. Vol. 13. No. 7. pp. 506–508.*

The discovery of a Leucocytozoon in a Brazilian owl is an event of considerable interest. In 1908, LUTZ and MEYER reported the discovery of one of these parasites in an owl in the same country, but no particular emphasis was laid on the fact, since they considered that it showed no appreciable difference from types of Leucocytozoon in the owls of the old world. In 1918, MARCEL LEGER, in his reports on very extensive haematological studies in Guiana, remarks on the non-observation of any Leucocytozoon, concluding that possibly the previously reported case may have been open to doubt and suggesting that no leucocytozoon is to be found in South America.

The parasite described in this report was observed by CARINI some time ago, but no mention was made of it at the time, since he decided to wait for further cases in order to make his studies more comprehensive. In consequence of the statements of LUTZ and MEYER, and of LEGER, it seems desirable to describe it now.

The leucocytozoon in question was found in a specimen of *Scops brasiliensis*, and parasites were numerous in the blood and organs. The host cell, which, as is usual in a leucocytozoan infection, was not identifiable, was fusiform and individuals varied from 32μ to 45μ in length. The nucleus was always enlarged, flattened and reduced in staining capacity except at its point of contact with the parasite; here it took the form of a fine, intensely stained narrow strip somewhat broader and rounded towards the ends, so that a "dumb-bell" impression was produced.

As regards the parasites, the male and female gametes were sharply contrasted. The females (macro-gametes) were oval, measuring 15–17μ by 10–12μ, and showed many vacuoles in the substance of an intensely blue-stained cytoplasm; the nucleus was small and sharply circumscribed and in some cases an intensely purple-stained paranucleus was observed very close to the main nucleus. The male gametes were somewhat smaller, measuring 12–14μ by 7–9μ. The protoplasm took on a delicate pink colour and appeared to be homogeneous; in addition the nucleus was large and not sharply delimited. No other forms were seen, but it was incidentally noticed that a species of Halteridium was also present.

* Abstracted by Mr. S. C. J. Bennett, B.Sc., M.R.C.V.S.

The author is not prepared, on the evidence to hand, to state that the described Leucocytozoon is a new species, but suggests that if further investigations prove it to be such, the name *L. lutzi* be given in honour of LUTZ, who first discovered it.

BENOIT-BAZILLE (H.). **Note sur une** *Grahamella : Grahamella musculi*, **n. sp., trouvée dans le sang de** *Mus musculus*. [Note on a *Grahamella : Grahamella musculi*, n. sp., found in the Blood of *Mus musculus*.]—*Bull. Soc. Path. Exot.* 1920. June 9. Vol. 13. No. 6. pp. 408–416. With 1 plate.*

This article places on record the discovery of a species of *Grahamella* in a host not hitherto recognized as a vector of these bodies, and suggests the provisional designation *G. musculi* to avoid confusion with the many other similar bodies found by various authors in several other animals.

The infection was discovered in two common white mice previously inoculated with *Trypanosoma brucei*, and the bodies were observed in the red corpuscles, sometimes in great numbers ; in some instances up to 50 in one corpuscle.

As regards morphology, the bodies measured 0·5–1·2μ long by 0·2μ broad, being distinctly bacillary in shape. In examining blood smears, affected corpuscles were seen at the rate of about one every five minutes. JOLLY bodies were also seen, but were deliberately excluded from the counts as having no connection with the *Grahamella*.

Beyond some *T. brucei*, with which the mice had originally been inoculated, some JOLLY bodies, and some polychromatic erythrocytes, the blood showed no other abnormality.

The author, quoting the great variety of animals showing *Grahamella* in their blood, and the large variety of other blood parasites with which they have been associated, concludes that these bodies are independent of the other parasites. Of their parasitic nature he is moderately convinced, since the animals in which they were found had been bought in the open market and not bred in the laboratory. Having been kept, probably caged alongside many other species of small animals, it seems probable that the infection may have been transmitted to them by some biting ectoparasite. No such bodies had ever been seen amongst mice bred in the laboratory.

STAMMERS (G. E. F.). **Haemogregarines in Black Rats.**—*Jl. Trop. Med. & Hyg.* 1920. Dec. 15. Vol. 23. No. 24. pp. 298–299. With 3 figs.*

The author recalls a report by KUSAMA, KASAI and KOBAYASHI (*Kitasato Arch. of Exp. Med.* 1919. Oct. Vol. 3. No. 2), in which they record the finding of haemogregarines in wild black rats in Tokio. As these parasites do not seem to have been described as occurring in European black rats this note is of some interest. The parasites here reported were found in Scandinavian black rats caught on timber ships from Sweden, but the author has so far failed to demonstrate their presence in native English black rats.

One of the figures accompanying the note shows a free extracellular parasite (gametocyte) and it is noted that in the rat from which the preparation was made, all the parasites were extracellular. The two other figures are of a haemogregarine and *Trypanosoma lewisi* mixed infection and of a double intracellular haemogregarine infection.

* Abstracted by Mr. S. C. J. Bennett, B.Sc., M.R.C.V.S.

LANGERON (M.). **Sur une Hémogrégarine d'un Macaque.** [A Haemogregarine occurring in the Dog-faced Monkey.]—*Bull. Soc. Path. Exot.* 1920. Mar. Vol. 13. No. 3. pp. 165–7.*

The author here reports the discovery of a haemogregarine in a monkey (*Macacus cynomolgus*). At the time of its discovery the observers were chary of publishing the fact, as it was not with certainty identifiable. Since then, however, haemogregarines have been seen in primates—by KREMPF in 1917 in a Chinese, and by ROUBAUD in 1919 in a European from the Belgian Congo.

The observation here reported was in the case of a monkey in 1912. This animal had succumbed to experimental inoculation with malaria (*Plasmodium cynomolgi*). In the process of blood examination bodies were encountered, which were described in the following terms :—

" They are considerable bodies (17–19μ by 5–6μ) constituting a mass which stains intensely blue by Romanowsky ; this mass includes a nucleus-like body which takes the azurophile tint characteristic of the chromatin of protozoa. One of these bodies is surrounded by a distinct pink zone and appears to be included in a distended red blood corpuscle ; the others appear to be free in the plasma. The morphology and staining of these organisms suggest the gametes of a haematozoon, but the absence of pigment forces one to discard this idea."

The descriptions given by KREMPF and ROUBAUD of the haemogregarines found in man recalled these bodies, and re-examination of the blood smear proved that they must be of this nature. The pink zone, originally described as encircling one body, had faded away, so that there was no evidence on which to base any statement as to whether they were intra- or extra- corpuscular.

The origin of the parasite remains obscure. The monkey came originally from the East—probably Indo-China—and was at that time presumably affected with haemogregarines. If so, the infection must be persistent, for the animal had been kept in a laboratory for over a year before being inoculated with malaria.

The discovery of this new variety is of interest in that it confirms the infestation of primates by these parasites. Probably their presence is often overlooked owing to their resemblance to *Plasmodium* gametes.

The author here proposes the name of *H. blanchardi* in honour of his former director with whom he was working when the parasite was first observed.

In a later note (*Bull. Soc. Path. Exot.* 1920. June. Vol. 13. No. 6. p. 394), following the information that a parasite was already recognized under the name of *Haemogregarina blanchardi* (BRUMPT and LEBAILLY, 1904), the author suggests the name *H. cynomolgi.*

DELANOE (P.). **De la spirochétose des Gallinacés dans le Cercle des Doukkala.** [Fowl Spirochaetosis in the Doukkala Circle, Morocco.] —*Bull. Soc. Path. Exot.* 1921. June 8. Vol. 14. No. 6. pp. 316–320.

The presence of spirochaetes in fowls was demonstrated by VELU in Morocco in 1918, but since 1915 Delanoe suspected the condition in the Doukkala Circle on account of the high mortality among fowls during the summer, the clinical symptoms, the rapidity with

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which recovery was brought about by a single injection of novarsenobenzol, and the number of argasid larvae on the fowls, particularly under the wings, during the hot weather. In 1920 the author made a few experiments upon the disease. It was found that the fowl spirochaete could be transmitted to the goose and duck, which subsequently developed serious symptoms and died quickly after intravenous injection with infected blood. The naturally-occurring disease was manifested under two principal clinical types, viz.: (1) The acute type, terminating rapidly in death. Very frequently the natives stated that their fowls died suddenly, and it was particularly at the time when they laid their eggs that they were liable to fall down dead. (2) The subacute or chronic type, with more or less marked paralysis or paresis of the legs. It is probable that there also exists a benign type, with more or less complete absence of visible signs of disease. The transmitting agent was *Argas persicus*, Fischer, which was very abundant in all fowl houses. The larvae, in particular, were very numerous in summer, so much so that the fowls' bodies were thickly covered.

The spirochaete exhibited usually five or six spirals (max. 8, min. 3). The average length was 14·3μ (max. 19·9, min. 11). The average width was 0·6μ (max. 0·7, min. 0·5). The question as to whether the Moroccan affection is identical with the Algerian disease still remains open. It seemed probable that fowls were not the only animals attacked with the disease, for outbreaks were found to occur among geese and ducks at the same time as the spirochaetosis produced losses in the fowl houses. Although spirochaetes were not discovered in the blood of diseased ducks and geese, support is given to this view by the fact that the author was able to cure a four months' old goose by means of a single injection of novarsenobenzol.

DISEASES DUE TO METAZOAN PARASITES.

ZUELZER (Margarete). **Biologische Untersuchungen an Zecken.** [Biological Researches on Ticks.]—*Zeitschr. f. Immunitäts-forschung u. exp. Therap.* 1. Teil. Orig. 1920. Sept. Vol. 30. No. 2. pp. 183–201.*

The ticks considered in this article are the *Argasinae*, and of these *Argas persicus* in particular. This group of ticks is of especial interest in that its members do not remain for any considerable period on their hosts, but indulge in occasional attacks only, behaving more like bugs than like the majority of ticks.

Argas persicus is recognized as the transmitting agent of fowl spirochaetosis, and is closely related to ticks of the genus *Ornithodorus* —the transmitting agents of human relapsing fever.

Argas persicus prefers a habitat which is warm and dry—26°C. being the optimum temperature. It also prefers darkness and normally hides in cracks and fissures where little light penetrates. The individuals vary in appearance according to the amount of food in

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their alimentary canals, being greyish-brown when fasting and a warm red-brown when recently fed. They can fast for considerable periods—at any rate for three or four months without any harmful results. The statements of some investigators that they can remain without food for a year are probably too liberal. They will remain alive for nine months, but after such a prolonged fast will not feed again. Under natural conditions they suck blood every three or four weeks.

When placed on a captive fowl the ticks are seen to suck blood in the usual way, changing in shape meanwhile from flat to round; the actual course of the blood may be seen as it flows into the ramifying intestinal system. The meal extends over a period of 20 minutes to an hour or more; some females take up to one and a half hours, but in all cases the ticks leave the host at the end of the meal. A single tick will at one meal suck a quantity of blood about five times its own original body-weight.

At the end of the meal the ticks are round and distended; all irregularities and furrows on the body surface are obliterated. After a variable period, which can be shortened by incubation at 37° C., a large drop of water-clear fluid is secreted by each tick from the coxal glands inside the first pair of legs, and the original wrinkled and flattened appearance returns to some degree. The drop of fluid is usually about the same weight as a fasting tick, and after its excretion the parasite will attack the host once more.

A considerable volume of this fluid was collected from several ticks and tested with rabbit anti-fowl serum in a narrow tube. A distinct zone of precipitation at the junction of the two liquids proved that the excreted drops of fluid were rich in fowl serum proteins. This fact, that an animal can absorb foreign protein and re-excrete it unchanged, is of considerable interest.

In the case of the allied ticks, it was observed that *Argas reflexus* (normally parasitic on the pigeon) behaved similarly, but on rare occasions secreted the drop of fluid while still attached to its host. *Ornithodorus moubata*, however, appears to remain attached in nearly every case, and after excreting its drop of coxal fluid continues its meal without resting.

Further information seemed desirable as to the significance of the drop of secreted fluid. Formerly it had been thought that it was retained during the meal to retard clotting of the ingested blood. At the conclusion of the meal, as it was no longer necessary, it was excreted. From the nature of the fluid and from the behaviour of *O. moubata*, this hypothesis seems unjustifiable. Bearing in mind that the ticks under consideration transmit spirochaetes, it was decided to ascertain whether, and to what extent, the fluid might play a part in the process. Several *Ornithodorus moubata* ticks, known to be harbouring the spirochaete of relapsing fever, were fed on a healthy rat and the coxal fluid collected in capillary pipettes at the moment of its secretion. This fluid, when injected intraperitoneally into a healthy mouse, produced acute relapsing spirochaetosis, with very rich blood invasion. Thus it is quite certain that the fluid plays a part in transmitting disease. Presumably the infected tick sucks blood from the healthy host, and the spirochaete-infected coxal fluid gains entrance to the host's body through the wound made by the mouth parts of the parasites. It has yet to be proved whether the actual bite of the tick is also infective, as is known to be the case with lice. [See, however, MESNIL'S explanation, p. 141.—ED.]

Precipitation tests on faecal material from the same ticks failed to reveal the presence of any unaltered protein material from the host. The passage of unaltered foreign protein, however, is not confined to ticks. Many other blood-sucking parasites were found to do the same thing, but in the absence of coxal glands the undigested protein was found to be passed with the faeces.

The life-habits of *Argas persicus*, as in other ticks, appear to be governed mainly by the feeding habits. The ticks can fast for long periods, but during these periods there is no copulation. After a meal, however, the ticks copulate within half an hour to two hours—after excretion of the coxal fluid. The act lasts for a period of from five to fifty-five minutes. It was noticed that the sexual desire in females persisted only for two or three days after a meal, but in males up to a month. In any case the females, provided that they had been fertilized after a previous meal, proceeded to lay eggs within a few days after a meal, even without fresh coition. If fertilized, however, the laying of eggs commences after a rest of from five to fourteen days, the process occupying a period of from three to six days from beginning to end. The number of eggs laid varies from 30 to 300 according to the amount and quality of the blood ingested at the last meal. At the conclusion of the egg-laying process, the females are ready to feed again and the whole process will be repeated. If ticks are being reared it is wise to enforce a rest of some weeks after every third or fourth egg-laying; otherwise the ticks will die of exhaustion.

A point of interest is the length of life and of fertility in *Argas* ticks. The author quotes an instance of a male and female known to be four years old; after copulation the female laid 50 eggs.

The nature of the blood ingested is as important a factor as the quantity. The ticks will feed on guinea-pigs for years and remain apparently normal, but the number of eggs laid is greatly reduced. Experiments were therefore instituted in order to determine whether fowl proteins were embodied in the substance of the eggs. A rabbit was injected with egg extract, but the resultant serum, although highly specific against tick egg albumen, gave no positive results when tested against fowl serum (precipitation tests). This same rabbit's serum was used for similar tests against egg extracts of various other Arthropoda, but with negative results in all cases, except with the egg extract of *Argas reflexus*, thus proving a very close relationship.

The larvae, which hatch out in from one to three weeks, according to the temperature, also show a distinct precipitation reaction with the same rabbit serum. After they have once fed on a fowl, however, their extract reacts to anti-fowl serum only, and after their first moult reacts to neither anti-tick-egg nor anti-fowl serum.

The first moult occurs when the larvae are from a fortnight to a month old, and the nymphs appear. The nymphs undergo four moults, the first three at approximately fortnightly periods and the fourth and last anything up to a month after the third. After each moult the nymph is obliged to feed, but cannot do so for a few days, as time must be allowed for the chitin of the mouth parts to harden.

The adults bite at the fourth or fifth day, but do not become fully engorged. After a rest of a day or two they bite again and gorge fully, after which they copulate and, in the case of females, lay eggs.

The whole life-cycle may take nearly six months in the colder part of the year, and in the summer time may be as short as three months.

The most important biological points indicated in these researches are referable throughout to the feeding habits of the ticks under consideration. They can remain for long periods without food, and during the fasts the body functions are inhibited. When food is plentiful, on the other hand, the whole life process is accelerated. Again, in virtue of their parasitic habits the ticks are often saturated with foreign albumen, so much so that it may be demonstrated by precipitation tests in their glandular secretions. In spite of this, each stage of the life-cycle may, however, be shown to have its own specific proteins.

GATES (William H.). **A Method of Concentration of Parasitic Eggs in Faeces.**—*Jl. Parasitology.* 1920. Sept. Vol. 7. No. 1. p. 50.*

" After straining through a sieve a large quantity of material, or using a smaller quantity without this, faeces are centrifuged first with water to wash off surplus lighter material, and later with sodium chloride, or, better, calcium chloride solution, specific gravity 1·250, to remove the bulk of the material and float the eggs practically free from sediment. The top 1 or 2 cc. are then removed with a pipette, drawing chiefly from the rim of the meniscus, and centrifuged again with water, which throws the eggs to the bottom. . . . . The sediment is agitated vigorously by holding the tube in the closed hand and pounding on the table. This stirs up all, or nearly all, of the eggs which may have stuck to the bottom, though a few eggs cannot be removed except with a brush. The sediment is quickly poured into a small dish. The centrifuge tube is rinsed out by squirting water forcibly into it, and this also is poured immediately into the dish. The eggs settle rather rapidly and are loosened from the bottom by forcing a little water around the edge to produce a slight whorl. Then, before the eggs have a chance to settle, agitate the dish in the same circular direction so that the water tends to form a vortex, gradually diminishing the motion. . . . . Practically all the eggs will be found to have settled within a very small field.

" For gross examination with the low powers, the eggs may be left in the dish and examined directly. To examine more carefully, under a high degree of concentration, draw up with a pipette a small quantity of water from the centre of the mass of eggs ; hold this vertical and steady for half a minute or so. Most of the eggs will settle, so that a single drop forced out on the slide will contain nearly all, if not all, of the eggs drawn up into the pipette. For still further concentration allow the eggs on the slide to settle, and then with a blotter or lens paper very carefully remove a portion of the water from the top of the drop and add another drop. If repeated with care, a large mass of eggs may be collected in the space of a cover-slip. This is especially satisfactory if the eggs have been in alcohol, for the alcohol will evaporate, leaving the eggs in the centre."

HORNBY (H. E.). **Some Notes on Liver Fluke Disease as Observed in Northern Rhodesia.**—*Vet. Jl.* 1921 May. Vol. 77. No. 5. pp. 171–174.

In Northern Rhodesia and the adjoining countries, *Fasciola gigantea* has become the cause of widespread ravages among the cattle population. The rainy season in these countries occurs from November to April, and during the dry season the rivers dry up and water is obtainable only from isolated pools and springs. Until recently the intermediate host of the liver fluke in South Africa was not known, but the researches of CAWSTON (F. G.) and of PORTER (A.)

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have indicated that *Limnoea natalensis*, together with some other water snails, such as *Physopsis africana*, are capable of harbouring the intermediate stages. The cercariae identified by CAWSTON as *C. pigmentosa* have been found by PORTER to be a stage in the life-cycle of *F. gigantea* [see this *Bulletin*, 1920. Vol. 8. No. 3. p. 206].

The above-named two species of snail are common in Northern Rhodesia throughout the whole of the rainy season, and Hornby found that they harboured numerous cercariae. During the dry months they are not so readily found. The snails flourished best in the kind of water which forms apparently the ideal drinking place for cattle, viz., the backwaters of the great rivers and the shady grass-fringed pools of the "sweet vleis." The Physa snail appears to be unisexual, and eggs are laid in packets of about 25, which appear to hatch out after only a few days' incubation, and the young snails attain full size within a month. Neither snails nor eggs appear to be resistant to desiccation, and re-stocking of pools seems to be effected every year by the floods.

It is therefore advised that the low-lying pastures should be avoided during the rainy season and cattle watered in the rapidly flowing small streams with sandy banks devoid of vegetation. Unfortunately the best ranches of Northern Rhodesia lie along the banks of the great swampy rivers, the plains on each side of which are deep under water during the rainy season, but gradually dry up later, furnishing, as the water recedes, an abundance of excellent grass during the whole season of drought. It is difficult to devise any measures for ridding such ranches of water snails, and large areas of excellent grazing are therefore spoilt by the presence of flukes.

The effect of invasion is most marked in cows and yearlings, and an infested cow becomes rapidly emaciated after parturition. Young stock vary much in the extent to which they show signs of infection. Adult oxen show very little outward appearance of infestation even when their livers are full of flukes. No signs of acute peritonitis or hepatitis were noticed in cattle during the passage of the parasites via the peritoneal cavity. Diagnosis is easily made by post-mortem examination of any apparently affected animal in a herd. Medicinal treatment did not give promising results. Male fern was considered to be too expensive for general use. Kamala was given by placing an ounce of it on the back of the tongue on two successive evenings, but hitherto no good results have been obtained.

CHRÉTIEN (A.). **Onchocercose du Zébu de Madagascar et du Boeuf de France.** [Onchocerca Infection of the Zebu in Madagascar and of the Ox in France.]—*Rev. Path. Comp.* 1921. Feb. 5. Vol. 21. No. 176. pp. 46–49.

During the course of work in connection with a meat preserving factory in Madagascar from 1917 to 1919, the author observed the presence of a nematode, often in large numbers, in nearly all the zebus examined. The parasite invaded the connective tissue around the ligaments and tendons, but it did not appear to be able to penetrate these structures. It was especially in the neighbourhood of the cervical ligament, in the median connective tissue of its various layers, that the lesions provoked by this parasite could be seen, and even the parasites themselves when the lesions were at their commencement.

Although they were not so easily visible, both parasites and lesions were quite numerous in the connective tissue surrounding the peri-articular ligaments and, in particular, in the connective tissue surrounding the knee and hock joints and in the connective tissue of the limb tendons.

When the parasite is isolated, as is often seen when the invasion affects the limb tendons, it is not easy to demonstrate it. Nevertheless, on close examination one can perceive within the connective tissue a worm of about the thickness of fine thread, which is always twisted or more or less loosely entangled, and hence it is impossible to follow it along its whole length. No macroscopic lesion can be seen around isolated individuals at this stage. The parasite can be easily extracted in fragments. The extracted portion takes the form of a thin, silky, supple thread often from 10 to 20 cm. long, and assuming of its own accord an irregular corkscrew arrangement. If instead of a single organism several are situated in the same place, as is usually the case in the cervical ligament, the connective tissue becomes slightly thickened and a little opaque and rough.

The connective tissue always adheres fairly closely to the tendinous tissue at the infested part. The lesions are distributed in irregular zones of more or less considerable size, of a somewhat brownish tint and surrounded by oedematous zones often of rather considerable extent. In the central zone of such lesions one may perceive a certain number of parasites in the form of small packets of worms, the presence of which sets up a distinctly inflammatory reaction in the invaded tissue. The worms may still be fairly readily extracted partially, but they are no longer supple. In other lesions a state of chronic inflammation is found to have become established. There is no longer to be found an oedematous condition of the connective tissue, and all that remains is a thickened, firm connective tissue zone of a whitish colour, within which may be found brownish entangled parasites of an appearance exactly recalling that of fine vermicelli. The small portions that can be extracted are now quite brittle. When the parasites are abundant there are often found within these lesions small greenish abscesses from the size of a pin's head to that of a pea. Moreover, there are often seen irregularly shaped nodular swellings of a dull white colour enclosing a firm homogenous caseous material. The various appearances exhibited by these lesions represent successive stages in the development of the parasite.

Again, histological examination lends confirmation to these deductions.

When examined microscopically the parasites appear as nematodes possessing a thick striated cuticle showing spiral thickenings interrupted in the neighbourhood of the lateral aspects of the body. The parasite thus belongs to the genus *Onchocerca*.

The author subsequently made a search among cattle slaughtered in Paris in order to find out whether similar manifestations could be found. It was discovered that the worms were quite frequently present in the connective tissue covering the cervical ligament, but beyond this situation the parasite was not found in the numerous other situations in which it could be discovered in the Madagascar zebus. As in the case of the zebu, investigations bearing upon its presence in the aorta of the ox gave negative results and histological examination of the frequently occurring atheromatous lesions did not disclose any evidence of parasitic infection. The lesions in the cervical ligament

were exactly similar to those found in the zebu, with the exception that in the final stage the parasite was often totally calcified. Microscopic examination of the parasites likewise showed that they belonged to the genus *Onchocerca*, but the species to which they belonged has not yet been determined. Whilst it might be stated that all adult zebus in Madagascar were affected, the cervical ligament of French cattle was affected in 71 per cent. of cases. The author entertains the hope that the discovery of the infection among cattle in France will lead to the elucidation of the life-cycle of the parasite. [This question has been somewhat anxiously studied in Australia, where Onchocerca infection, particularly in the brisket, renders the affected meat unsaleable.—ED.]

HALL (Maurice C.). **Carbon Tetrachlorid for the Removal of Parasitic Worms, especially Hookworms.**—*Jl. Agric. Res.* 1921. April 15. Vol. 21. No. 2. pp. 157–175.

Experiments carried on in the Zoological Division in the United States Bureau of Animal Industry indicated that carbon tetrachloride (CCl_4) is a very promising drug for the treatment of hookworm infestation in dogs, and it would also appear that it may be of use in the treatment of ankylostomiasis in man and in domesticated animals other than the dog. Hall reviews the work that has been done in connexion with the medicinal use of this drug. At one time it was thought that its administration was indicated for the same purposes as those for which chloroform was used, but for the last 50 years it does not appear to have been much employed for this purpose on account of the belief that it had a more depressant effect upon the heart than chloroform had, and its volatility and supposed difficulty of elimination were objections to its use in large doses. During recent years it has been largely used as a hair shampoo, but about two cases of fatal intoxication are on record in the human subject. BISHOPP (F. C.), of the U.S. Bureau of Entomology (1920), stated that the drug irritates wounds and retards healing, and two stockmen were under the impression that they killed two calves and one steer by its use in cases of screw-worm infestation. The substance has also been somewhat extensively tried as an insecticide, but it would appear to be inferior in this respect to carbon bisulphide and sulphur dioxide. During the war, however, it was noted to be an effective insecticide for lice.

Carbon tetrachloride is less volatile and distinctly less soluble in water than chloroform or carbon bisulphide. It does not seem to diminish the tone or contractility of unstriped muscle. It also boils at a temperature 15-30° C. higher than the other two substances mentioned. It may carry impurities such as phosgene and carbonyl chloride, so that care should be taken to obtain pure samples of the drug.

In the experimental tests on dogs the method employed was the same as that used in the author's previous work on anthelmintic efficacy [see this *Bulletin*, 1918, p. 103].

The animals were submitted to treatment and all faeces passed were collected once a day for 3–6 days, screened, and the worms passed were identified and counted up to the time when the animals were killed; the worms present post-mortem were then identified and counted, and any lesions that might be due to the drug noted. In the first batch of 20 dogs the drug was administered in capsules after fasting for 18–24 hours, without preliminary purgation. In seven cases where the dogs harboured *Dipylidium* sp., treatment with the drug in

doses from 0·2–1 mil (cc.) per kilo body weight was entirely ineffective against this tapeworm ; it is therefore regarded as of no value against Dipylidium or probably against tapeworms of other genera. With regard to nematode worms, however, the results were as follows :—

At the rate of 0·1 mil per kilo, to four dogs : hookworms 23 removed, 30 left (43 per cent. efficacy); ascarids 34 removed, 9 left (79 per cent. efficacy) ; whipworms none removed, 2 left (0 per cent. efficacy).

At the rate of 0·2 mil per kilo, to four dogs : hookworms 1 removed, 3 left (25 per cent. efficacy); ascarids 1 removed, 1 left (50 per cent. efficacy); whipworms none removed, 11 left (0 per cent. efficacy).

At the rate of 0·3 mil per kilo, to nine dogs: hook worms 34 removed, none left (100 per cent. efficacy); ascarids 6 removed, none left (100 per cent. efficacy); whipworms 19 removed, well over 200 left (less than 10 per cent. efficacy).

At the rate of 1 mil per kilo, to one dog : hookworms none present ; ascarids 2 removed, 1 left (67 per cent. efficacy) ; whipworms 16 removed, none left (100 per cent. efficacy).

At the rate of 1·5 mil per kilo, to one dog : no worms removed, but none found post-mortem. No ill-effects as the result of the treatment were observed ante-mortem or post-mortem.

From these experiments it would appear that a dose-rate of 0·3 mil per kilo is necessary to remove efficaciously hookworms and ascarids. On the other hand, whipworms, as the author has previously pointed out, cannot be removed with certainty by single-dose treatment with any known anthelmintic.

In a second series of experiments the drug was administered by drench instead of in capsules, to fasting dogs, without purgation. The result was :—

At the rate of 0·3 mil per kilo, to three dogs : hookworms 16 removed, 22 left (42 per cent. efficacy); ascarids 43 removed, 22 left (66 per cent. efficacy); whipworms none removed, 95 left (0 per cent. efficacy). It is thus evident that the drug ought to be introduced in capsules in order to develop its maximum effect.

When given in large doses without capsules the drug was found to produce transient toxic effects which were attributed to the inhalation of the drug. A dog was thus administered : 1 mil per kilo of the drug in castor oil ; half of this was first given without capsules and the second half afterwards in capsule. The dog went down and stiffened for a short time, and then arose and staggered about as if intoxicated for a few minutes. It soon became normal in behaviour and appearance, and at the end of four months' observation showed no evidence of ill effects.

In order to ascertain whether thymol, which is readily soluble in carbon tetrachloride, could, if added to it, produce an increase in anthelmintic efficacy, a solution was made up containing 10 gr. of thymol per 1 mil carbon tetrachloride. This solution was administered in capsules after fasting without purgation.

The result was :—

At the rate of 0·3 mil per kilo, to three dogs : hookworms 66 removed, none left (100 per cent. efficacy); ascarids, none present ; whipworms none removed, 22 left (0 per cent. efficacy). The mixture would therefore be as effective as carbon tetrachloride alone in the same dose, and a larger series of experiments might show that it was more effective.

Likewise, in order to ascertain whether oil of chenopodium could be added to carbon tetrachloride, with an increase in anthelmintic

efficacy, a solution was made up, containing 3 mils of the latter drug to every 1 mil of the former. The solution was administered in capsules after fasting and without purgation. The result was :— At the rate of 0·3 mil per kilo, to two dogs : hookworms 110 removed, none left (100 per cent. efficacy); ascarids 8 removed, none left (100 per cent. efficacy); whipworms 65 removed, 12 left (84·5 per cent. efficacy); *Dipylidium* sp. none removed, 1 left (0 per cent. efficacy). The mixture was therefore as effective as carbon tetrachloride used alone in the same dose, and a larger series of experiments might show that it was more effective. This mixture was also given at the same dose-rate, by means of a syringe, to one dog that was too savage to be dosed successfully by means of capsules. The method, however, resulted in complete failure, inasmuch as part of the dose was necessarily lost and partly evacuated from the mouth and by slobbering.

Hall next summarizes the results he had previously obtained after the administration of other anthelmintics for the treatment of hookworm infestation. The drugs tested were chloroform and chenopodium, alone and in mixture, and thymol. Chloroform in doses of 0·1 to 2 mil per kilo in castor oil was only 54 per cent. effective against hookworms, while in single and repeated doses in soft capsules it was entirely ineffective. Chenopodium and its constituents in single or repeated doses had an average efficacy of 20 per cent. against hookworms ; in the doses commonly employed for removing hookworms from man (three 10 min. doses at one hour intervals), it was only 30 per cent. effective, and its maximum efficacy in any series of dogs used was only 74 per cent. Chloroform and chenopodium mixed, for all cases reported, showed an average efficacy of 69 per cent., the maximum efficacy for a series being 89 per cent., in cases where dogs were given three 5–10 minim doses in soft capsules at one hour intervals, each dose, accompanied by half an ounce of castor oil, and followed half an hour later by 4 mils of chloroform in half an ounce of castor oil— this dose of chloroform being in excess of 0·3 mil per kilo for the average dog (a 10-kilo dog). Thymol showed an efficacy of 15 per cent., and according to tests made by GAIGER, it left hookworms in seven out of nine dogs treated, with no evidence as to infestation in the other two dogs.

Hall claims that none of the drugs hitherto experimentally tested have shown the 100 per cent. efficacy against hookworms displayed by carbon tetrachloride. The best results obtainable were those given after the use of repeated doses of chenopodium, followed by chloroform. Chloroform alone appeared to be better than chenopodium alone, while the results obtained with thymol were very poor.

The author, moreover, carefully studied the ante-mortem and post-mortem conditions of the dogs undergoing treatment. He concludes that " it appears to be a very safe drug, giving rise to no evident symptoms or post-mortem lesions, even in doses five times as large as are necessary to give dependable efficacy against hookworms. It is cheap and deserves to be tested in human and veterinary medicine. Because of the possibility of impurities, only a pure and carefully refined carbon tetrachloride should be used. While this drug deserves consideration, with especial reference to hookworms, it is also very effective for removing ascarids, being somewhat inferior to chenopodium in this respect, and will remove whipworms, as other anthelmintics will, when it gets into the caecum. It is not of value against tapeworms."

MYCOTIC DISEASES.

VELU. **Le diagnostic de la lymphangite épizootique par l'examen microscopique des frottis sans coloration.** [The Diagnosis of Epizootic Lymphangitis by Microscopic Examination of Unstained Smears.]—*Rec. Méd. Vét.* 1921. Mar. 30. Vol. 97. No. 6. pp. 127–129.*

The method suggested by Velu is one particularly suited to the colonial veterinary officer, who must often travel over considerable distances without a microscope, thus making direct examination of fresh pus impracticable.

The technique consists in making the pus smear in the ordinary way and fixing in a mixture of alcohol and ether. The cryptococci show up as ovoid bodies, either free or intracellular, with a slightly bluish, highly refractile membrane. This is enclosed in a double-lined contour, the inner contour appearing as a distinct sharp black line. This picture is quite characteristic, as the black line separating the outer bluish layer from the central material (which is somewhat pink in colour) must be unmistakeable.

This method is, of course, for simple diagnosis only, and not for pursuing a study of the cryptococcus.

BACHMANN (A.). **Sur la présence de cryptocoques pathogènes dans les ganglions des chevreaux goitreux.** [On the Presence of Pathogenic Cryptococci in the Glands of Goitrous Kids.]—*Bull. Soc. Path. Exot.* 1921. Apr. Vol. 14. No. 4. pp. 199–202. With 2 figs.*

Attention was first drawn to the possibility of a cryptococcus infection of young goats following a post-mortem examination made on a kid sent to the author's laboratory. The peripheral lymphatic glands were greatly enlarged, the inguinals and axillaries especially. Portions of these glands were retained for histological examination and experimental inoculation.

Histological examination revealed the presence of very large cells in the lymph nodules, measuring on an average 16 by 13μ, with a vesicular faintly staining nucleus measuring 8 by 6μ.

Inside these cells other bodies were to be seen, varying in number from one or two to ten or twelve in each cell. These included bodies stained intensely with ordinary basic stains and were gram-fast. For the most part they were ovoid in shape and stained regularly, but some forms were seen in which the stain was distributed in the form of bands or points or in some cases confined to the two poles.

Experimental inoculation of triturated material into guinea-pigs produced symptoms of general discomfort in from 10 to 15 days. The peripheral lymphatic glands became swollen and tense, but in no case was the disease fatal; the guinea-pigs gradually became more natural, and the swellings in the glands subsided.

Some guinea-pigs were destroyed at the height of the period of indisposition and their lymphatic glands examined histologically. A similar picture was presented to that seen in the glands of the kid which provided the original material. In the guinea-pig the large cells measured on an average 18 by 16μ, and the included bodies from 1·8 to 3·6μ.

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All attempts at cultivation failed.

It is suggested that the bodies described here may be cryptococci ; the hypothesis being based on morphology, staining reactions and difficult cultivation.

BACTERIAL DISEASES.

BASSETT-SMITH (P. W.). **Para-Melitensis Infection in Man and Animals.**—*Jl. of Trop. Med. & Hyg.* 1921. Mar. 1. Vol. 24. No. 5. pp. 53-54. With 2 figs.*

The *Micrococcus para-melitensis* first isolated by BRUCE was shown to be specific and distinct from *M. melitensis* by NÈGRE and RAYMOND. The specificity was based on the results of agglutination and adsorption tests in addition to animal inoculation.

In this article attention is drawn to the group similarity between *M. melitensis, M. para-melitensis* and *B. abortus* (BANG). It appears that *M. para-melitensis* is distinctly more bacillary in form than the true *M. melitensis,* being in fact morphologically almost indistinguishable from BANG'S abortion bacillus. From the results of experiments by other investigators it seems that Malta fever and BANG'S abortion organisms are biologically related also ; this is a matter of great importance from a lacto-diagnostic point of view, particularly as many goats in the Mediterranean countries are said to be infected with *M. melitensis* or *M. para-melitensis.* The question is worthy of further investigation. [*See also* this *Bulletin,* 1920, Vol. 8, No. 4, p. 323.]

ROÉLAND (C.) & CHRÉTIEN. **Pasteurellose du lion.** [Pasteurellosis in the Lion.]—*Rev. Path. Comp.* 1921. May 5. Vol. 21. No. 182. pp. 168-171

Towards the end of 1920 the authors had occasion to examine three adult Soudanese lions belonging to a menagerie in the neighbourhood of Paris. These lions were kept in the same cage and all died within a few days of each other, showing much the same symptoms.

The first animal had frequently showed signs of intestinal trouble, and bore a fistula in the jaw which was continuously discharging a little. The first signs of serious illness were frequent vomition, and the animal appeared dull, very thin, and the coat was rough. Suppuration from the jaw had ceased. Four days later the animal was very much worse and extremely emaciated and showed complete loss of appetite. There was oedema of the lips and forearm. The animal died this day, but no post-mortem examination was made.

The second animal had never shown signs of illness previously, except that at one time it had had abscess in the jaw. At the time that the first animal died it was in complete health, but nine days later there appeared oedema of the lips and limbs and the suppurative discharge from the jaw ceased. On the following day the animal succumbed. Post-mortem examination was made the next day. The

subcutaneous tissue in the region of the chest was oedematous, the lungs and bronchial glands were markedly congested, and the myocardium was discoloured towards the apex of the heart, whilst the endocardium was markedly tinged. The liver was enlarged and congested, the spleen appeared normal, the kidneys were congested, the mucous membrane of the stomach was of a livid red colour; the intestine appeared normal, but the mesenteric glands were swollen. Stained smears from the lung, spleen and mesenteric gland showed, besides a few rare Gram-staining bacilli and cocci, numerous very delicate ovoid forms with a clear centre which did not stain by Gram. Cultures made from these organs showed, besides a few rare streptococci, numerous pasteurella colonies.

Two guinea-pigs were inoculated, one intraperitoneally and one subcutaneously, with material from the lungs. The guinea-pig inoculated intraperitoneally died within 24 hours, and, post-mortem, it showed exudative peritonitis, with a slight purulent deposit on the borders of the liver, intestinal congestion, slight enlargement of the spleen, and a small amount of exudate in the pericardial cavity. Microscopic examination disclosed abundant pasteurella organisms in the peritoneal fluid and spleen. Cultures made from the blood, pericardial and peritoneal fluids gave rise to a pure growth of pasteurella organisms.

The guinea-pig inoculated subcutaneously fell ill in 24 hours and died within 48 hours after the injection. Post-mortem there was seen a small abscess at the point of inoculation, together with congestion of the neighbouring subcutaneous connective tissue, a small amount of peritoneal exudate and slight enlargement of the spleen. The peritoneal exudate and pus disclosed pasteurella organisms on microscopic examination. Cultures made from the blood and brain developed the organisms in a state of purity.

The third lion had also been in a state of very good health, but it was found sometimes to lick the abscesses on the first two animals. It suddenly became ill eight days after the death of the second animal and showed symptoms of extreme depression and loss of appetite, and died on the following day, 15 hours after the first appearance of symptoms. A post-mortem examination, however, was not performed until 48 hours after the death of the animal, when generalized congestion of all the organs was found, as in affections of the haemorrhagic septicaemia type. In particular, several small pneumonic foci were discoverable in the right lung, together with congestion and enlargement of the spleen. Microscopic examination of the blood, spleen, and bronchial glands disclosed fairly numerous pasteurella organisms, together with so-called malignant oedema and coliform organisms. The same forms were observed in cultures. Inoculation was not performed on account of the degree of invasion with organisms of the malignant oedema type.

The authors think it is admissible that these three cases represent pasteurella infections. The weather at the time of the fatalities was extremely cold. [However, the post-mortem examinations were not made until 24 and 48 hours after death, and therefore conclusive proof is not furnished by these observations. It would have been necessary to examine heart blood immediately after death in order to exclude the probability of post-mortem invasion with the pasteurella organisms.—ED.]

LITCH (V. M.) & MEYER (K. F.). **A Spontaneous Epidemic among Laboratory Rabbits caused by a Paratyphoid Bacillus related to the Rodent Group.**—*Jl. Infect. Dis.* 1921. Jan. Vol. 28. No. 1. pp. 27–42.*

The organisms responsible for spontaneous bacterial infections among laboratory or breeding rabbits are most commonly *B. cuniculisepticus* and *B. bronchisepticus*, but a case in which true paratyphoid B was the exciting factor is here reported. From the information available this is, apparently, a rare cause, but several cases are on record.

According to KRUMWIEDE, VALENTINE and KOHN (*Jour. Med. Research*, 1919, Vol. 34, p. 449) the paratyphoid strains isolated from guinea-pigs, mice, rabbits and cats, differ antigenically from human paratyphoid B strains (*B. schottmülleri*) and, in their view, belong to a distinct type or group—so-called "rodent paratyphoid."

In the outbreak here reported the disease was introduced among a lot of rabbits purchased for the laboratory, one of which—a female—was found to have diarrhoea and showed signs of a previous abortion. The animal died a few days afterwards, and four other rabbits that had been in contact with it subsequently succumbed.

The symptoms exhibited were high temperature, hair rough and easily shed, in some cases a sero-purulent nasal discharge, loss of appetite, great thirst and marked pallor of mucous membranes, due to a distinct drop in haemoglobin from 90 to 52 per cent. The animals developed severe diarrhoea a few days before death, which was frequently accompanied by a paresis of the posterior extremities and involuntary passage of urine. There was a quickened pulse, laboured breathing, a fall of temperature and convulsions signalizing the approaching termination in from 4 to 8 days after the onset of symptoms.

The principal lesions were: More or less marked emaciation. The anterior lobes of the lungs were covered with a thin layer of fibrin, the lung parenchyma was consolidated in lobar distribution or showed an infarct-like area surrounded by patchy pneumonia. The anterior portion of the middle lobes showed red and grey hepatization. The blood was thin, and sometimes of a brownish tinge. The spleen was considerably enlarged, engorged, pulpy, and of a dark brown colour. Both kidneys were enlarged, yellowish-brown in colour, and showed petechiae and extensive parenchymatous degeneration. The mesenteric lymph glands were enlarged and haemorrhagic. The liver was increased in size and either dark or pale in colour, friable, and dotted with small necrotic foci of varying sizes. The gall bladder was distended by a dark olive-green viscid bile, and its wall was thin and soft, but no changes were visible in the mucous membrane. The duodenum was filled with stringy bile-tinged mucus and its mucous membrane was swollen and showed petechiae. Peyer's patches in the jejunum were swollen, deep red, ulcerated, or covered by brownish-red scale-like sloughs. The sacculus rotundatus was considerably thickened, the lymphatic structure being studded with numerous deep haemorrhages and small pinhead-like abscesses. The mucous membrane showed extensive sloughs in two spontaneous cases, as did that of the appendix, and was covered by a glossy, blood-tinged slime. In two rabbits infected artificially by feeding the wall of the caecum and colon was strikingly rigid, with a diffuse diphtheritic necrosis of

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the mucous membrane in contrast to the scattered ulcerations observed in the spontaneously infected animals. The uterine horns of two rabbits were enlarged, contained partially dissolved, putrid foetuses, and an endometrium covered with yellowish necrotic areas, thus suggesting the possibility that certain types of abortion in rabbits may be caused by paratyphoid bacilli. In one case the epididymis was oedematous, haemorrhagic, and showed on section numerous areas of necrosis.

Histological examination of some of the organs revealed changes not commonly encountered in paratyphoid infections of laboratory animals. An endarteritis and endophlebitis were noted in every tissue, not only in the spontaneously, but also in some of the experimentally, infected animals. Again, the characteristic hyperplastic reaction regularly found in human typhoid fever was entirely absent, or indicated only by a few scattered microphages and phagocytes.

The organism isolated on brilliant green eosin agar or peptic endo-agar from the heart blood, intestinal content, wall of jejunum, ileum, sacculus rotundatus and caecum, liver, spleen and lung was a gram-negative, motile bacillus. The result of fermentation and other biochemical reactions showed that it belongs to the *B. schottmülleri* type of the colon-typhoid group.

Agglutination Tests.—The strains isolated from the various tissues were readily agglutinated in the first generation by a polyvalent human paratyphoid B (*B. schottmülleri*) serum in a dilution of 1 : 500 and were not influenced by a highly potent *B. enteritidis* serum in dilution above 1 : 10. Agglutination tests with antisera against paratyphoid strains of rodent, avian, porcine and human origin showed that the organism isolated is a paratyphoid B closely related to the rodent type of this large group and does not belong to the avian, human or porcine type.

Pathogenicity.—The rapid progress of the epizootic indicates that the organism was of a virulent type, and transmission from rabbit to rabbit probably took place by way of the digestive tract in the form of a feeding infection. Mice and guinea-pigs inoculated subcutaneously with a minute dose died in 12–24 hours. The organism was not fatal to rabbits in small doses by subcutaneous inoculation, but produced more or less extensive necrosis and local abscesses. After ten days the animal's serum would agglutinate the bacilli in dilution of 1 : 400 to 1 : 800. Intravenous inoculation, on the other hand, was fatal in comparatively small doses in 2–10 days, and it produced a diphtheritic or even necrotic cholecystitis. Feeding experiments on coccidiosis-free rabbits proved that the ingestion of two billion recently isolated organisms produced the disease, with characteristic lesions, but that on subcultivation the organism gradually lost its virulence, until ultimately very large doses were necessary to infect. Infection by feeding did not produce a cholecystitis, thus agreeing with the spontaneously infected cases, but differing from those set up by intravenous injection. The bile, too, remained sterile, thus suggesting that in natural cases in rabbits infection of the gall bladder, when it occurs, is not due to an ascending invasion via the common and cystic duct, but is probably the result of descending invasion.

Toxin Production.—When grown in peptonized sugar-free veal broth plus 0·1 per cent. glucose, the organism produces a toxin which is rapidly fatal to rabbits by inoculation, but it should be noted that the reaction of the medium must be adjusted to a PH of 8·4. With a PH 7·2–7·4 the filtrate is not nearly so powerful.

The possibility of the organism here considered being concerned in food poisoning in man must not be overlooked. In one instance McCONKEY (*Journ. Hygiene*, 1906, Vol. 6, p. 570) isolated a paratyphoid organism from the leg of a rabbit which was suspected of causing an outbreak, but although he was able to prove in the particular instance that the rabbit when purchased was fit for human consumption and that contamination took place at the consumer's house, yet the ability of the organism, described in this article as setting up a disease of rabbits, to evolve a potent toxin should be considered in any attempt to explain outbreaks of food poisoning in which rabbit flesh is part of the suspected meal.

The history of this epizootic among rabbits emphasises the necessity for laboratory workers to make a thorough investigation of the death of all stock animals and to impose a strict quarantine of at least two weeks on all animals received into the laboratory.

GRAHAM (Robert) & SCHWARZE (H.). **Avian Botulism (Type A) or Limber Neck.**—*Jl. Infect. Dis.* 1921. April. Vol. 28. No. 4. pp. 317–322.*

The disease known as limber neck has been recognized for many years in the poultry flocks of America. It is of a toxaemic nature and occurs sporadically. The symptoms exhibited are weakness, inco-ordination of movement, prostration, coma and inappetence, while the striking feature of the disease is a weak pendulant or limber neck.

It is possible that this train of symptoms may be induced in poultry by a variety of agents, but there is evidence to show that at least in some natural cases the causal organism is *B. botulinus* Type A. In investigating a case of botulism in man, DICKSON (Monograph No. 8, *Rockefeller Inst. for Med. Research*, 1918) noticed that a fatal illness in chickens developed simultaneously, and he was able to induce the disease in healthy chickens by feeding them with contaminated human food and to isolate *B. botulinus* from the alimentary tract of the affected birds. Other investigators who had attempted to confirm his results by feeding *B. botulinus* toxin to chickens had failed to set up the disease, but the authors of the present article were successful when using the toxin of several strains of *B. botulinus*, each of which proved to be *B. botulinus* Type A.

Their results were quite negative with strains of *B. botulinus* Type B, which strongly suggests that the failure of the other investigators to induce the disease was due to their working with strains of the latter type.

It is an important fact, however, that although chickens do not become diseased when fed with *B. botulinus* Type B, yet the faeces of chickens fed with this strain are highly toxic to susceptible animals, which indicates that the virus may be distributed in nature by apparently healthy chickens or other resistant animal species.

The results here reported strongly suggest that the type of any strain of *B. botulinus* may be readily and accurately recognized by feeding the toxin to chickens. In an outbreak of botulism the type responsible may be preliminarily determined by feeding the unaltered contaminated food to chickens. Moreover, should an outbreak of botulism in animals reveal the remote or even simultaneous occurrence

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of limber neck in chickens, the authors recommend the use of specific *B. botulinus* antitoxin Type A, and they further believe that the latter antitoxin is indicated in the treatment of this disease in poultry in preference to the polyvalent variety. They have proved experimentally that Botulinus antitoxin Type A is a specific prophylactic, the injection of 50 units being quite sufficient to protect mature chickens against 800 lethal doses of toxin for guinea-pigs. The curative value of the antitoxin in chickens has not been tested sufficiently to permit of definite conclusions.

Type B antitoxin has no effect in controlling the disease as induced by Type A.

DISEASES DUE TO FILTERABLE VIRUSES.

TITZE (C.) & SEELEMANN (M.). **Weitere Untersuchungen über die Lungenseuche des Rindes und über die Differenzierung sogenannter ultramikroskopischer Seuchenerreger.** [Further Researches on Bovine Pleuro-pneumonia and on the Differentiation of the so-called Ultramicroscopic Viruses.]—*Berliner tier. Woch.* 1921. Jan. 20. Vol. 37. No. 3. pp. 29–31.*

The virus of contagious bovine pleuro-pneumonia is of great interest in that it should serve as a starting point for the investigation of filterable viruses. It is itself "filterable," but is none the less visible and capable of being cultivated, as in MARTIN'S broth with the addition of ox serum or by the collodium sac method. A more minute study of this virus may be of help in indicating a line of research in the case of other diseases due to filterable viruses.

One must, however, in the first place, be quite sure that the organism in question actually is the cause of bovine pleuro-pneumonia. It has been stated that it is not (FREIBERGER—*Ztschr. f. Infekt. Krankh.* Vol. 12, p. 455), and that similar or rather identical bodies are to be seen in the blood-serum of healthy and diseased men and animals. To clear up this point cultures were made in serumized MARTIN'S broth. On incubation at 37°C. the medium became slightly and uniformly turbid after from three to five days; this turbidity could only be due to the presence of a large number of minute "bodies," and, knowing that injection of this culture into cattle will produce a local lesion similar to that produced by fresh pleuro-pneumonia lymph, the only doubt which can be entertained is as to whether the small bodies in the culture are actually the causal organisms or some product of these.

Microscopic examination of the cultivated bacilli with dark ground illumination showed them up as bright foci, but as the cedar wood oil behaved so as to produce images of other bright foci, it was discarded and pure distilled water used for immersion of the optical system. Under these conditions the bodies appeared to be, on the whole, round in shape; sometimes ring forms were seen and on occasion two or three bodies in a chain were seen. There was never any polymorphism to the extent of finding filamentous or branching forms. As to their motility, no definite proof of this could be established; the only movement actually observed was the ordinary "Brownian" movement common to all small bodies. Control material examined in the same circumstances did not show anything similar to the bodies described

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above. Small bodies were seen in sterile MARTIN'S broth and serum, but they were quite dissimilar, resembling bodies also present in the cultures which were considered to be non-specific.

Having found a specific body, the question to be considered was as to whether it was the causal organism itself, or merely a reaction product. It was decided to attempt an agglutination test. A yearling bull was given 10 cc. of a 40 days' MARTIN'S broth culture intravenously. No untoward result followed; in fact, there was absolutely no clinically apparent reaction, but after nine days the agglutinating titre of the bull's serum rose to 1–50. A heifer was also similarly treated but the material was injected subcutaneously at first. A considerable local reaction followed, with swelling up to the size of a man's head after about a week. This dose was followed by larger ones and even by pleuro-pneumonia lymph, but no further reaction was observed. Nine days after the last injection the agglutinating titre of the serum was 1–100.

The agglutination technique was as follows :—A pure culture in MARTIN'S broth was taken—eight days' growth—and divided after shaking into portions of 5 c.c. in small sterile tubes. To these tubes were added on the one hand normal ox serum and on the other hand serum from the immunized animals in varying dilutions. One tube of non-serumized culture was used in each test as a control. The whole series was incubated for 24 hours and then centrifuged at high speed. In all the tubes the organisms were thrown to the bottom. The vital point of the test now followed; all tubes were shaken and the results were found to be as follows:—In the non-serumized control tube slight shaking mixed the deposit of organisms with the overlying liquid, forming a uniform turbidity ; the culture treated with normal serum behaved similarly, but that treated with serum of the immunized animals broke up only into a few coarse clumps. This phenomenon may be accepted as proof that the organisms demonstrated microscopically are the causal organisms.

Confirmatory phagocyte tests were next carried out. MARTIN'S broth cultures were distributed in quantities of 2 cc. in small tapered centrifuge tubes, and to each tube the same quantity of a standardized emulsion of guinea-pig leucocytes (washed) was added. Series of these tubes were then treated on the one hand with normal serum and on the other hand with serum from the animals immunized against pleuro-pneumonia, whilst some were not treated with any serum, being retained as controls. All tubes were now incubated and examined after sedimentation of the leucocytes. It was noted that the tubes treated with immune serum had cleared considerably, while those treated with normal serum and the controls were as turbid as before. The organisms had been phagocyted in the presence of the "opsonins" of the specific immune serum. It was not possible to prove that the organisms were actually included inside the leucocytes since, owing to their minute size, they are extremely difficult to demonstrate in such circumstances, but their disappearance from the emulsion is sufficient proof.

It may be concluded that the results of these researches are very encouraging and it may be that in the near future one may overcome the alleged "ultravisibility" by some modification of the technique employed in these tests for agglutination. As to the practical application of the facts and results, numerous experiments on an extensive scale will be required to warrant any conclusion.

GINS (H. A.). **Versuche über die Vakzination der Schafe.** [Experiments on Sheep Vaccination.]—*Zeitschr. f. Hyg. u. Infektionskr.* 1920. Vol. 90. pp. 322–336.*

Early literature on the subject of sheep vaccination is both vague and contradictory. It has been held that treatment of sheep with true sheep lymph is dangerous, and as regards cow lymph, some authors advise and some deprecate its use. Passage of the bovine material through several sheep has been advised in order to increase its potency. Moreover, in any case the earlier experiments appear to have been insufficiently controlled, since the various methods of vaccination have only been adopted in times of necessity (*Notimpfung*) and virulent sheep-pox has been too prevalent on such occasions to permit of exclusion of natural infection. It was therefore considered to be not only desirable but even necessary to make further investigations; the political situation in South Eastern Europe makes the menace of sheep-pox less remote than usual.

The first series of experiments deal with the effect of vaccination of sheep with cowpox.

A sheep was inoculated on the body by scarification with ordinary glycerinized calf lymph. A local pox lesion developed, but there was no systemic disturbance or tendency to spread. From this lesion material was inoculated direct to another sheep and at the same time was tested on a rabbit by scarification of the skin and cornea. Both the second sheep and the rabbit developed local pox lesions and the cornea of the rabbit later proved to be rich in GUARNIERI bodies. From the second sheep material was inoculated on to a third sheep, and another rabbit, and here again the lesions were exactly as at the first inoculation. Thus neither inoculation with cowpox nor with "ovinized" lymph is dangerous as no systemic disturbance is set up, and there is no tendency to generalization either with bovine material, or material passaged through sheep.

Attempts to set up any form of local or general disease by means of inhalation (six experimental sheep) failed.

Experiments with sheep-pox material gave quite different results. A three months old lamb, still with its mother, was inoculated by scarification on the body. Swelling and inflammation set in at the seat of inoculation within three days, but even after seven days there was no sign of pustule formation. Simultaneously with the skin inoculation some material suspended in salt solution was injected under the mucous membrane of the lip and an extensive inflammation and infiltration developed around the point of injection; the mucous membrane began to separate on the seventh day. Systemically the lamb was depressed and off feed, but after shedding the mucous membrane of the mouth lesion, its good spirits and appetite returned (16th day). The material constituting the body lesion was removed on the ninth day showing the raw corium underneath. At this period there was no necrosis of the skin, and although this condition developed a few days later the necrotic skin was soon shed and the lesion healed completely.

The mother sheep showed no lesions or symptoms for 18 days, but at this period developed a most severe generalized form of pox—exanthema, photophobia, stomatitis, conjunctivitis—and at length died 11 days after the onset of symptoms. Post-mortem examination

* Abstracted by Mr. S. C. J. Bennett B.Sc. M.R.C.V.S.

showed the usual acute lesions internally. This experiment is of great interest in that it demonstrates the different effects of experimental and natural infection with sheep-pox material.

An inhalation experiment was performed with scab material from the sheep which succumbed. A sheep thus treated developed general symptoms, which first appeared in the 18th day and to which it succumbed on the 21st day.

A further series of experiments was conducted, embracing the sheep already used in the first experiment (vaccination with calf lymph and passaging of "ovinized" lymph). The experiments and results were :

1. Sheep which had received only glycerinized calf lymph inoculated with virulent sheep material. This sheep developed pox on the 8th day and died on the 14th day.

(NOTE.—The glycerinized lymph had been stored for a month and had lost some of its potency.)

2. Sheep which had a month previously received "ovinized" lymph of the first passage was now tested with virulent material. No symptoms were developed.

3. Sheep which had three weeks previously received "ovinized" lymph of the second passage, now tested with virulent material. A slight local exanthema developed which cleared up in about a week.

4. Sheep which had about six weeks previously received fresh calf lymph diluted 1 : 3 now tested with virulent sheep material. No symptoms beyond temporary local erythema.

5. Sheep which had five weeks previously received "ovinized" lymph of the first passage now tested as usual. This sheep developed symptoms on the 5th day and died on the 13th day.

A review of these few experiments affords some useful information. Glycerinized calf lymph and "ovinized" calf lymph both give immunity to sheep-pox. As seen above there was not sufficient protection in every case since two experimental sheep died of pox. This failure to protect may be referred to lack of potency in the material used in the first place. The first vaccination with calf lymph was not successful, but the lymph had been stored for some time (four weeks), but a similar experiment with *fresh* calf lymph, even in a dilution of 1 : 3, afforded sufficient protection. The fact that "ovinized" lymph failed in one case is not so easy of explanation. The material had undoubtedly lost some of its potency as was proved by experimental inoculation of the cornea of a rabbit ; a 1 : 50 non-glycerinized emulsion of the material produced only small localised necrotic areas, whereas normally a 1 : 400 emulsion will set up an inflammatory process involving the whole cornea. It seems therefore that calf lymph used in a fresh condition is the best material to employ and that "ovinization" tends to reduce rather than intensify its potency.

Attempts were now made to produce immunity by inhalation. Six wethers were used, with a seventh as control, and the inhaled material was from fresh cowpox lesions. After an interval of eight weeks all seven wethers were made to inhale virulent sheep-pox material. In the case of three of them, no symptoms of pox developed while three others developed small papules round the nostrils and muzzles which soon subsided ; the control sheep developed pox symptoms on the 16th day and died on the 20th day. It is therefore apparent that inhalation of fresh cowpox material confers a solid immunity against death from sheep-pox.

Further experiments were conducted in order to establish the value of skin vaccination with cowpox as a protection against inhalation of sheep-pox and *vice versa*. Sheep so treated appeared to be immune when tested, but owing to the age of the virulent test material even the controls did not die so that the results cannot be considered decisive.

A review of the whole series of experiments shows that cowpox is transmissible to sheep, but that even the most potent material will only produce mild symptoms. Again, vaccination of sheep with cowpox confers a solid immunity against subsequent infection with sheep-pox and the more virulent the cowpox material, the greater will be the immunity produced.

For the benefit of veterinary surgeons who may wish to adopt vaccination in practice it will be interesting to note also that the area of skin vaccinated appears to have some bearing in addition to the virulence of the vaccine. In these experiments four light surface cuts each about two inches long proved to be sufficient, but as to the minimum requirements no tests were made. The seat is preferably the body inside the fore leg, in the first place because any damage to the hide in the event of a severe reaction will be of little account, and secondly because there is not so much danger of soiling and secondary infection as would be the case if the operation were performed in the hitherto popular seat—at the root of the tail.

The good results obtained in immunisation by inhalation make one wonder whether this method could not be adopted on a large scale—say with a large spray in a sealed room. If such a course were adopted, care would have to be taken to allow all infected vapour to clear away or settle down before attendants were allowed to clean the chamber out; it is not known whether human beings react to inhalation of virulent sheep-pox. If the method were practicable it would be of immense value, since thousands of sheep could be treated in a single day—allowing, say, half an hour for each lot with a vapour made from one part of calf lymph to 20 of saline.

These experiments. although so successful in Germany, should, in order to be conclusive, be performed again in some country in which sheep-pox is enzootic.

GORDZIAKLOWSKI. **Note sur une nouvelle inoculation préventive contre la peste bovine.** [Note on a New Method of Preventive Inoculation against Cattle Plague (Rinderpest).]—*Rec. Méd. Vét.* 1921. Feb. 15–Mar. 15. Vol. 97. Nos. 3 and 5. pp. 115–116.*

The method advocated is based on the fact that organisms in many cases are attenuated by heat. During the course of an extensive outbreak of cattle plague in Poland the usually adopted measures were found to be inadequate; slaughter and disinfection could not be adopted on a sufficiently wide scale to produce good effects. Furthermore, the simultaneous serum and virulent blood inoculation was impracticable owing to lack of veterinary surgeons and general organisation. It was therefore decided to test the efficacy of blood from infected animals attenuated by heat.

The technique employed consisted in withdrawing blood from infected cattle in the "second stage," that is to say, when they showed fever and buccal lesions, but before the onset of diarrhoea. The blood

* Abstracted by Mr. S. C. J. Bennett, B.Sc., M.R.C.V.S.

was defibrinated and heated in shallow dishes at 55°C. for 10 minutes, and then at 48°–50°C. for an hour. As a preliminary test the dose of this heated virulent blood was fixed at 1 c.c.

The first experiment with the heated blood was performed on 28 cattle in an infected establishment, each of which was given 1 cc. (presumably subcutaneously). Nearly all of these cattle developed some fever—104°-105°F.—and three of them succumbed. These three deaths may be passed over lightly when it is remembered that they occurred in an establishment already infected with cattle plague ; the victims were probably in the incubation stage when first treated. The remainder recovered and were dosed with fully virulent blood after an interval of twelve days from the first injection. None showed any ill effects.

Another case is quoted in which 120 beasts in three establishments were similarly treated and none of these succumbed to the first vaccine.

The author concludes that virulent cattle-plague blood may be attenuated by the method described and successfully used as a first vaccine, to be followed later by virulent blood.

CURASSON (G.). **Les lésions cutanées dans la peste bovine et le rôle des peaux dans la transmission de la maladie.** [The Cutaneous Lesions of Cattle Plague and the Rôle of Hides in the Transmission of the Disease].—*Rec. Méd. Vét.* 1921. Jan. 15. Vol. 97. No. 1. pp. 19–26.*

Cattle plague has always been described as an acute exanthematous disease, but in the descriptions of most writers the skin lesions have either been disregarded or rapidly passed over. Furthermore, many authors regard any cutaneous eruption as exceptional, whereas Curasson in this article records his opinion that in all cases of rinderpest running a normal course they are the rule. The question is gone into in detail and a minute description of the lesions is presented as observed in a recent large outbreak of cattle plague in West Africa.

The lesions make their appearance in the second stage of the disease along with conjunctivitis, stomatitis and diarrhoea ; if they are not noticeable until later it is because at their development they were small and discrete. Small round red spots appear varying in number and proximity, usually in parts where the skin is thin and the hair fine ; sometimes they appear all over the body, but it is exceptional to see any lesion below the knee or hock. Where they occur, the hair stands on end in a manner similar to that observed in ringworm. Later, these lesions develop into papules and then pustules. The pustules then break, causing matting of the hair in the neighbourhood ; the appearance varies in detail according to the position and number of the lesions. Generally, the skin, now denuded of epithelium, has the same appearance as it would have following the application of a vesicant. Eventually the hair grows through slowly and covers the bare patch of skin ; and this new hair is in nearly every instance found to grow " against the grain " of the pre-existing hair. In some cases the animal is so badly infested with the skin lesions as to be rendered almost bald when the scabs fall off : in such cases the deeper layers of the skin are also invaded, and if the beast recovers, large hairless cicatrices remain.

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Such are the lesions seen in cases running the ordinary course. In very acute cases, owing to the rapid death of the patient, they are often never developed. Similarly they are more rare in calves and yearlings because these immature animals are more prone to develop a hyperacute form of the disease.

The skin lesions of cattle plague are of considerable interest from a sanitary point of view and may be of great value in helping an inspector to estimate the danger or otherwise involved in transporting cargos of hides. An accurate estimate is, however, only to be made if one can differentiate the lesions referable to cattle plague from those caused by injuries of various kinds. In rinderpest hides, the lesions would usually show as fairly regular round areas up to a sixpence in size, with the hair growing in a different direction from that on the surrounding parts. Such areas would be found as a rule on the insides of the legs and the side of the neck. Larger areas of similar appearance might be seen along the back and on the croup. In hides from animals which had developed a general skin form of the disease, the hide would be irregularly pitted and the depressed areas would be hairless as if resulting from a burn or scald. Mistakes, however, can be made in attempting to decide whether a hide has come from a rinderpest case or not. The most common conditions which may lead to a wrong decision are as follows :—

The treatment of the carcase by native butchers leads to damage of the hides in many cases ; the dead beast may have been dragged along the ground and bare patches produced ; the size and position of these should guide the inspector. Again, there may be scars from old wounds or burns, but these should not present much difficulty. Skins dried too rapidly in the sun may become corrugated and subsequent handling will rub the hair off the raised parts of the hide ; this feature should not be confounded with cattle plague lesions, since the hide will give a clue in virtue of the parallel ridges and furrows. The most difficult lesions to distinguish are those found on hides from working oxen ; harness galls are often of the size and shape of true cattle plague lesions. One must be guided by their position, as there are certain well known positions for harness galls, and these in the main are not the positions for cattle plague lesions. " Heating " of hides due to bad curing may cause some confusion at first, and one needs to have a practiced eye to " spot " badly treated hides. Dry-rot, caused primarily by severe bruises immediately preceding death, will produce circular skin lesions, but here the periphery of the lesion is a dull reddish brown colour and in the process of tanning the centre of the lesion usually falls out, leaving a hole. Another distinguishing feature is that they are more easily seen from the inside of the hide. The ravages of insects need present little difficulty, since long narrow channels are easily seen and in nearly every case a short examination will reveal excrement or larvae of the causal insect.

The next point considered is the danger of these hides as a possible source of infection. The author is of opinion that the importance of this point has been universally exaggerated. It is claimed that no case of cattle plague in French West Africa has been definitely traced to contagion from the hides of infected animals (the author's observations from 1915–1918), and it seems probable that the infective period of hides is short and the danger of their spreading the disease

is small unless they are transported immediately after flaying a fresh carcase. The author quotes an experiment in which he failed to reproduce cattle plague in a calf by inoculation of emulsion in normal saline of pieces of infected skin which had been exposed to the sun for four hours—the natives dry their hides by exposing them to the sun for several hours on two or three successive days. In addition to sun-drying the hides are, as a matter of routine, steeped in an arsenical solution to prevent the ravages of insects (potassium arsenate 2–3 per 1,000 for 12–24 hours).

In consequence, the French Ministry of Agriculture will allow the importation of dried hides into France provided thay have been sun-dried after steeping in the usual arsenical solution. For uncured hides they demand that before loading from Africa the hides must be treated with an efficient disinfectant—at present either 3 per cent. commercial cresyl, or 1/1,000 sublimate combined with 5/1,000 hydrochloric acid are used.

To sum up, the author concludes that the skin lesions of cattle plague are fairly typical and any reasonable treatment of infected hides removes all danger of spreading the infection.

REMLINGER (P.). **L'inoculation intrajugulaire de virus rabique chez le mouton et chez le chien.** [Intrajugular Inoculation of Rabies Virus in Sheep and Dogs.]—*Rec. Méd. Vét.* 1921. April 30—May 30. Vol. 97. Nos. 8 & 10. pp. 172–175.*

It has been stated that intrajugular injection of rabies virus should produce different effects in herbivora from those produced in other animals; in the latter rabies should develop, whereas in herbivora not only should the disease not develop, but a solid immunity should ensue. This divergence of results is due, according to HELMAN, to a difference in structure of the capillary blood vessels; those of herbivora tend to prevent the virus gaining access to the nerve centres whilst those of other animals have no such inhibitory power. The following experiments were instituted in order to throw some light on this hypothesis.

The first series of experiments were performed with nine sheep and eleven dogs, all of which received a dose of fixed virus of about the same size intrajugularly (from 5–10 c.c. of a milky emulsion.) The result was that, of the sheep two died and seven recovered, and of the dogs four died, five developed no symptoms and two developed symptoms but recovered. As there was no striking difference between the behaviour of dogs and sheep to the fixed virus, further experiments were performed with ordinary street virus.

For these tests brain material which killed rabbits in 20 days was employed; a one per cent. emulsion was prepared by trituration, roughly strained, and injected intrajugularly into 10 sheep and 10 dogs

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in doses varying from 2 c.c. to 10 c.c. The results are best shown, as in the original article, in the form of a table.

Sheep.	Quantity Inoculated.	Result.
1 ..	2 cc. ..	Survived.
2 ..	2 ,, ..	,,
3 ..	4 ,, ..	,,
4 ..	4 ,, ..	,,
5 ..	6 ,, ..	,,
6 ..	6 ,, ..	Died of rabies.
7 ..	8 ,, ..	Died of rabies.
8 ..	8 ,, ..	Showed suspicious symptoms, but recovered. Afterwards immune.
9 ..	10 ,, ..	Died of rabies.
10 ..	10 ,, ..	Died of rabies.

Summary.—4 deaths, 6 survivals; deaths, 40 per cent., survivals, 60 per cent.

Dogs (all adult).	Quantity Inoculated.	Result.
1 ..	1 cc. ..	Survived.
2 ..	2 ,, ..	,,
3 ..	4 ,, ..	,,
4 ..	4 ,, ..	,,
5 ..	6 ,, ..	,,
6 ..	6 ,, ..	Died of rabies.
7 ..	8 ,, ..	Survived.
8 ..	8 ,, ..	Died of rabies.
9 ..	10 ,, ..	Died of rabies.
10 ..	10 ,, ..	Died of rabies.

Summary.—4 deaths, 6 survivals; deaths, 40 per cent., survivals, 60 per cent.

The first five animals of each series were subsequently tested as to immunity by inoculation of virus into the anterior chamber; all were found to have developed immunity. The result of the experiments therefore with the street virus, as with the fixed virus, showed no difference in its action on adult dogs or sheep. It was decided to extend the tests with street virus so as to include puppies, and a parallel series of 10 puppies received varying doses of street virus with results as follows:—

Puppy.	Quantity Inoculated.	Result.
1 ..	2 cc. ..	Died of rabies.
2 ..	2 ,, ..	Died of rabies.
3 ..	4 ,, ..	Died of rabies.
4 ..	4 ,, ..	Survived.
5 ..	6 ,, ..	Survived.
6 ..	6 ,, ..	Died of rabies.
7 ..	8 ,, ..	Survived.
8 ..	8 ,, ..	Died of rabies.
9 ..	10 ,, ..	Died of rabies.
10 ..	10 ,, ..	Died of rabies.

Summary.—7 deaths, 3 survivals; deaths, 70 per cent., survivals, 30 per cent.

The author regrets that circumstances did not permit of extending the experiments to young herbivora (lambs, kids, calves) or to other species of adult animals. Also it must be remembered that the only channel of administration of the virus employed was intrajugular injection.

The conclusion to be drawn from the tests as actually performed is that adult sheep and adult dogs are affected in exactly the same way following intrajugular inoculation with rabies. Further, the most careful histological examination of capillary blood vessels, whether of the nervous or other tissues (*e.g.*, respiratory), reveals no difference in structure. The only difference that may count is the *thickness* of the capillaries; the thinner the capillaries the more likelihood is there of virus permeating them. This may be the explanation of the higher percentage of deaths in the puppies as compared with the adult sheep or dogs.

TEPPAZ (L.). **A propos d'un cas de rage humaine au Sénégal.** [A Case of Human Rabies in Senegal.]—*Rec. Méd. Vét.* 1921. April 15. Vol. 97. No. 7. pp. 207–209.*

Considerable discussion has arisen at various times concerning rabies in West Africa. It has been stated that rabies does not exist there, and that rabies, although it is present in the country, is not communicable to human beings. It is certain that the disease has been given very little attention, since no authentic case of fatal rabies has hitherto been reported in a European; the natives appear to neglect it entirely, either through their natural apathy or in virtue of the disease in dogs usually assuming the form of so-called "dumb rabies."

The case reported in this communication is that of a European who was bitten by a dog on the right hand and right knee (on July 18, 1920). He was admitted into Dacca hospital (on August 30, 1920) suffering from "spasm of the larynx and oesophagus" and died the same day. It transpired that the dog had at the same time also bitten a small dog belonging to the patient. Some time after receiving the bite, the patient complained of acute pain in the right hand, but as his dog, which had also been bitten, appeared to be all right he paid no attention to it. Later, however, the small dog became indisposed and eventually blind and paralysed in one fore leg (August 15, 1920). Consequently it was destroyed.

The owner now wished to proceed to Dacca to receive anti-rabic treatment *but was advised not to do so because no case of rabies had ever been recorded in a European in Senegal!* As stated above, he died a fortnight afterwards, six weeks after having been bitten. That he actually died of rabies was confirmed by experimental inoculation of rabbits and guinea-pigs.

BOUFFARD (G.). **De la rage canine en Afrique Occidentale Française.** [Concerning Canine Rabies in French West Africa].—*Bull. Soc. Path. Exot.* 1921. Jan. Vol. 14. No. 1. pp. 6–9.*

Mad dogs have been known to exist in West Africa ever since the district was first opened up, but many authorities have doubted whether the symptoms are the result of true rabies or whether there is another disease with similar symptoms which is responsible. Natives known to have been bitten by these mad dogs have never developed rabies and information culled from reliable sources tends to show that human rabies is unknown.

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CAZALBOU was convinced that the disease was true rabies, an opinion with which the author agrees, and TEPPAZ in the course of his veterinary duties in Senegal (1919) confirmed his diagnosis of a case of rabies by experimental inoculation [*see* preceding extract]. A comprehensive study of rabies at Dacca led HECKENROTH to conclude that true rabies is indigenous in West Africa and may be transmissible to man. He admits that the strains communicable to man may possibly be of recent importation, but can find nothing to prove that the local form of the disease may not be virulent for man in certain favourable circumstances.

The point at issue is that if there are two diseases, how may they be differentiated? It is certain that the African form cannot be "fixed," but HECKENROTH has remarked on the loss of virulence on the part of the European fixed virus sent direct to Dacca from the Pasteur Institute in Paris. On the other hand if there is only one disease how may one account for the differences in behaviour in Europe and Africa respectively? It has been suggested that the change is due to the difference in physical environment in Africa—heat, dryness, intensity of light—but no definite conclusion has been reached.

The author, in the course of experiments with West African rabies, attempted experimental inoculation of rabbits and guinea-pigs with brain material from dogs which had become naturally infected and showed typical clinical symptoms of the disease. The experimental animals developed rabies and died. Passaging was also attempted, but although all the animals inoculated developed rabies, the virus never became "fixed." An interesting fact was established; the virus found in Dahomey would after several passages attain a greater degree of virulence than virus originating in the French Sudan, killing with certainty in from 16 to 18 days. Beyond this, nothing definite can be said; the author is of opinion that the only way to settle the discussion is to test the African virus in Europe alongside the European virus.

MISCELLANEOUS.

KRAUS (R.) with KANTOR (L.), FISCHER (H.) & QUIROGA (R.). **Ueber die Aetiologie der Meningo-Encephalitis epizootica (Bornasche Krankheit).** [Concerning the Etiology of Meningo-Encephalitis Epizootica (BORNA Disease).]—*Zeitschr. f. Immunitätsf. u. exp. Therap.* Abt. I. Orig. 1920. Sept. Vol. 30. No. 2. pp. 121–143. With 9 figs.*

A comprehensive summary of previous work on Borna disease precedes the communication with regard to the authors' own research and mention is made of the multiplicity of opinion as to its etiology. The lack of macroscopic lesions and the characteristic histological alterations are taken as established features and it is particularly on the presence of the latter that the existence of the disease is confirmed. The accepted histological lesion is in the nature of an infiltration by

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lymphocytes of the perivascular lymph spaces of the smaller blood vessels in the grey matter of the brain and sometimes also of the spinal cord. Also according to JOEST cell-included bodies are to be seen in some parts of the brain.

The researches here described were instituted in order to ascertain whether intra-cerebral injection of brain substance of affected horses would reproduce the disease in experimental animals—primarily guinea-pigs and rabbits. The first experiment quoted is one in which brain substance from a horse which had shown Borna symptoms was injected subdurally into five rabbits. All died within 24 hours with no visible lesions on post-mortem examination. Subdural inoculation of more rabbits and guinea-pigs with their brain substance caused death in about three days. The same experiment with material from another horse produced the death of guinea-pigs and rabbits in 24 hours, but intraperitoneal inoculation was without any visible result. Material from a third horse killed rabbits in two days, while brain substance of sound horses and of horses dead or destroyed for other reasons caused no disturbance in control animals. Even material from horses with mal-de-caderas proved negative (an interesting point, since the brain shows lesions similar to those of Borna disease).

The total results of these direct transmission experiments showed that brain material from horses with the acute form of the disease will produce death in rabbits and guinea-pigs within 24 hours if injected intracerebrally. Subcutaneous or intramuscular injection was found to be less certain and the latent period more prolonged. Passaging from rabbit to rabbit or guinea-pig to guinea-pig is practicable with certainty intracerebrally and possible in many cases intramuscularly. In all cases when the experimental animals die there are no lesions appreciable to the naked eye.

Steps were next taken to attempt to demonstrate a causal organism, and it was found possible in every case to cultivate organisms from the brain substance, and in some cases from the blood, of rabbits killed by inoculation with brain material from infected horses. Material sown on agar plates and incubated at body temperature for 24 hours showed small colourless translucent colonies which at 48 hours became granular in the centre.

Microscopical examination showed that the cultivated organisms were cocci, easily observable in hanging drop preparations in which they executed lively "Brownian" movement, but they were difficult to stain. Prolonged staining (five minutes) with dilute fuchsine, LOEFFLER'S methylene blue, or aniline gentian-violet after warming revealed them as diplococci, in form not unlike meningococci but rather smaller. Sometimes cocco-bacillary forms could be seen. The organisms were definitely Gram-negative. Prolonged cultivation induced pleomorphism and the form became cocco-bacillary and then filamentous. Animal passage either through rabbits or horses, of the pleomorphic form, reproduced the original diplococcus.

Further observations showed that culture in broth produced turbidity and a slight film after 24 hours, the latter becoming a considerable scum after 48 hours; after some days a thready bottom growth appeared. Gelatine was not liquified, no haemolysis was observed in blood media, and acid was not produced in litmus-milk or neutral red media; sugars—lactose, mannite, glucose, and maltose—were not fermented and no growth occurred on Conradi-Drigalsky media.

The organism proved to be very susceptible to heat and common disinfectants—a temperature of 60°C. was fatal in an hour and a one per cent. solution of carbolic acid in 15 minutes.

The next essential step was to prove the pathogenicity of the organism. Rabbits, guinea-pigs and mice succumbed to intravenous or subcutaneous inoculation within two days (broth culture). Post-mortem examination revealed no lesions in these experimental animals beyond distention of the bladder, but the diplococcus could be recovered and cultivated from the brain substance or the blood. The virulence of the organism was very high, so that as small a dose as 0·001–0·0001 cc. of a two days' broth culture proved fatal intravenously after two to four days in the case of rabbits. To retain any considerable degree of virulence it was found necessary to transplant the broth cultures every three or four days, but even when this precaution was observed the virulence showed a steady decline. Similar results were observed when broth cultures of the diplococcus were injected into larger animals—goats, sheep and calves. Small doses were fatal subdurally, but larger doses (5 cc. for a goat) were necessary if given intravenously.

The most important inoculation experiments — with horses — gave similar, but not identical, results. Cerebral inoculation reproduced the disease with great certainty, whereas intravenous administration was extremely uncertain ; the horses often developed no symptoms by the latter method. Of eight horses inoculated intracerebrally, all died within periods varying from two to eight days, and the organism was recoverable from the brain substance and cerebro-spinal fluid. Of the same number inoculated, intravenously, only two died and from neither of these was the organism recoverable. Subcutaneous injections of large quantities of culture were negative.

The facts that two horses had died following intravenous inoculation and that the organisms had not been recoverable, suggested the possibility of toxic action. Further experiments with filtrates were, however, all negative.

Control experiments were performed with other organisms. Horses were inoculated subdurally with cultures of *B. coli*, Streptococcus and Meningococcus. The results were that both *B. coli* and the meningococci proved fatal. Post-mortem examination, however, was not macroscopically negative as is the case in Borna disease. In both cases meningitis was produced, but that due to *B. coli* was seen to be quite distinct from the disease under consideration. There was hyperaemia of the brain vessels and considerable increase in the number of leucocytes, but no perivascular lymphocyte infiltration. In the case of the meningococci a purulent meningitis supervened.

As a result of the above experiment, the author and his collaborators conclude that the diplococcus which they isolated, which they call the " diplococcus of enzootic encephalitis," is the cause of Borna disease, their argument being that it can be isolated from the brain substance of horses which have acquired the disease naturally, it may be cultivated, it may be passaged, it will reproduce the symptoms and lesions of the naturally occurring disease when injected into horses subdurally and it is recoverable from the brain substance of such experimentally infected horses.

JOEST (E.). **Einige vergleichend-pathologische Bemerkungen über Encephalitis lethargica.** [Some Comparative Pathological Notes on Encephalitis Lethargica.]—*Zeitschr. f. Infektionskr. etc. der Haust.* 1920. July. Vol. 21. Part 1. pp 97–99.*

In human pathology there has recently been considerable mention of encephalitis lethargica, which has been appearing sometimes sporadically and more often with the characters of an epidemic. Generally speaking, it is characterized by symptoms of inflammation of the brain, accompanied often by those of inflammation of the spinal cord. The most striking feature is a tendency to sleep.

Examination of the brain in fatal cases presents no macroscopic alterations, but histologically the appearance of a nonpurulent inflammation is recognized. The adventitia of small vessels is infiltrated with small cells, mainly small mononuclear leucocytes, accompanied by a few plasma cells. The alterations are confined to the grey matter of the brain—and sometimes also of the spinal cord.

In many instances the disease seems to have some connection with influenza, but is probably not identical with the latter.

Human encephalitis lethargica is of interest from a veterinary point of view in that the horse is attacked by a similar disease in which the clinical symptoms and histological features of the brain correspond very closely; this is "Borna disease" or encephalomyelitis enzootica equi. In fact, both conditions are very similar to sleeping sickness due to trypanosomes, both clinically and histologically. It is not known whether the desire for sleep in these three diseases is due to a specific toxin or merely to pressure applied by the infiltrated and thickened vascular adventitia. Probably the former is more likely, seeing that there is no tendency to sleep in rabies where the lesions of the brain are somewhat similar.

It might be considered from the foregoing remarks that human encephalitis lethargica is one of a group of diseases of the central nervous system which could be grouped as "encephalitis (or encephalomyelitis) lymphocytaria." Other members of this group would be rabies, fowl plague, canine distemper (nervous form), infantile paralysis and human sleeping sickness. So far human encephalitis lethargica appears to be a disease *sui generis*, but it would be interesting to pursue the histology farther; in particular to determine the presence or absence of cell inclusions comparable with those found in most of the diseases above mentioned.

NICOLAS (Ch.) **Résultats de dix années d'observation du** *big head* **en Nouvelle-Calédonie.** [Ten Years' Observation of Big Head in New Caledonia.]—*Bull. Soc. Path. Exot.* 1921. June 8. Vol. 14. No. 6. pp. 337–339.

This author has already written a number of short articles on this subject, but does not appear to have as yet elucidated the problem satisfactorily. He maintains that big head is a particular form of osteoporosis, which is quite different from true osteomalacia, inasmuch as it is contagious, although its morbid anatomy shows some degree of resemblance with that of the latter condition.

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* Abstracted by Mr. S. C. J. Bennett, B.Sc., M.R.C.V.S.

In New Caledonia the disease affects exclusively horses, of all ages. A few months' association with diseased animals seems to be sufficient to infect healthy subjects. Big head is a bilateral tumour of the lower jaw and may be differentiated on clinical grounds from osteomalacia, inasmuch as this condition is not contagious, and it rarely affects foals, and even though it may sometimes attack the lower jaw, it can be observed also affecting all the bones, and particularly the limb bones near the joints. A young animal affected with osteomalacia may also be attacked simultaneously with big head, but big head doess not necessarily affect all foals attacked with osteomalacia. Cattle—calves and young animals—may also be affected with osteomalacia, but they are never attacked with big head. Again, while osteomalacia seems to be due principally to a lack of or incomplete calcification of the bones, brought about by a deficiency of calcium in the food and especially in the maternal milk, big head appears to be caused by the action of a filterable virus. However, experimental proof of this assertion is not forthcoming. Absence of chalk in the soil, foodstuffs, and drinking water, appears to be a condition which favours the development of big head. In osteomalacia there is no satisfactory treatment, but big head seems to be amenable to treatment by the local application of an ointment and daily addition of an ounce or two of chalk to the drinking water.

EVANNO. **Cas de coryza gangréneux chez le Buffle.** [A Case of Gangrenous Coryza (Malignant Catarrh) in the Buffalo.]—*Rev. Path. Comp.* 1921. Mar. 5. Vol. 21. No. 178. p. 107.

The author, a veterinary inspector in the Sanitary Service at Cambodia (French Indo-China), observed among buffaloes several cases of malignant catarrh, and the diagnosis appears to have been confirmed by another veterinary inspector. According to MOUSSU and NOCARD and LECLAINCHE, this disease has not yet been observed in the buffalo, and it is described as a general infectious disease peculiar to the ox. The affection observed in the buffaloes was manifested in two forms, viz., (1) respiratory and (2) exanthematous, with no lesions on the pituitary mucous membrane or in the respiratory tract, but characterized simply by the presence of pustules on the whole body, and eye lesions. An important point was that these buffaloes lived in close proximity with cattle, none of which became infected. It is considered that the term coryza is defective, inasmuch as some of the animals did not show any signs of coryza.

CROVERI & SALVESTRONI (P.). **Observation sur l'hématologie normale et pathologique des bovidés de la Somalie italienne, spécialement considérée par rapport à la peste bovine et aux trypanosomiases.** [The Normal and Pathological Condition of the Blood in the Cattle of Italian Somaliland, considered particularly in its Relationship to Rinderpest and the Trypanosomiases.]—*Rev. Path. Comp.* 1921. March 5. Vol. 21. No. 178. pp. 105-107. [Summarised by M. FORGEOT.]

It is well known that the rinderpest virus resuscitates certain latent infections such as, for example, piroplasmosis, and thus the blood of a virus-producing calf may show nothing abnormal at the time of inoculation, but during the course of the disease set up by the injection piroplasms appear in the blood (usually on the fourth day) and the

virus carrier hence cannot be utilized for the hyperimmunization of cattle. It would therefore be of interest to ascertain if there are any methods by means of which these latent infections of the virus-carrier could be revealed. The above authors found that a systematic examination of the gland juice obtained from the pre-scapular or inguinal glands was a very good method.

In Italian Somaliland the infective agent that most often appears following upon the injection of rinderpest virus is a trypanosome, and it was found that the disease could be diagnosed in the early stages by gland puncture. Moreover, animals affected with trypanosomiasis exhibited a characteristic leucocyte formula.

The composition of the blood in normal zebus of every breed, of both sexes, and of every age, was first examined, and in particular animals employed as virus or serum producers (that is, animals from 12 months to three or four years old). It was found that the number of red corpuscles was substantially the same as in European cattle, but the number of leucocytes was slightly higher than in the latter. In animals affected with rinderpest the authors obtained figures which were slightly different from those published by BALDREY and REFIK BEY, and this discordance may be explained by the difference in localities in which the results were obtained.

Whereas Croveri and Salvestroni made their observations near the Equator at sea level, BALDREY worked on the Himalayas at an altitude of 2,500 metres. BALDREY and REFIK noted an increase in the leucocytes at two different periods, viz., (1) commencing 24 hours after experimental infection and reaching its maximum after two or three days, and (2) commencing on the sixth day, when the number of leucocytes had appreciably diminished. The Italian authors on the other hand, noted a perceptible diminution commencing on the second day and this decrease became more and more marked up to the time of death; in cases of recovery the decrease was maintained only up to the ninth day, and subsequently there was a gradual but very slow increase in the number of leucocytes, which did not resume their normal count until well after recovery.

Likewise the leucocyte formula showed variations which ran parallel with the variations in number of the leucocytes. The decrease affected exclusively the lymphocytes, it sank to half on the fifth day, and dropped to a quarter of the normal number just before death. The neutrophile polynuclears increased and the increase varied directly with the decrease in the number of lymphocytes. The eosinophile polynuclears diminished considerably and then disappeared towards the fifth day. Thus the Italian authors share the belief of a number of authors (NICOLLE, ADIL BEY, and others) who consider that the virus resides in the leucocytes and it is suggested that it is perhaps in the lymphocytes that it is mainly to be found. In this manner may be explained the failure of certain workers to filter the virus at the commencement of the disease, whilst it is still enclosed within the leucocytes, whereas it is filterable later, when as the result of the destruction of the white corpuscles it is liberated into the blood stream.

In trypanosome affections a marked diminution in the number of red corpuscles is noticeable (from 7,549,088, the normal figure, down to 4,260,000), a decrease which is never seen in a pure rinderpest infection. With regard to the leucocyte formula there is an increase in the lymphocytes. In their original paper the authors supply a table illustrating the leucocyte counts in rinderpest complicated with

trypanosomiasis. As in the trypanosomiasis, the authors found that in sarcosporidiosis there was a considerable diminution in the number of red corpuscles, and an appreciable diminution in the leucocytes. Tables are also furnished showing :—

1. The average corpuscular count in normal animals ;
2. The number of red corpuscles, leucocytes and leucocyte formula in rinderpest, from the first to the fifth day of the affection in cases of recovery or fatal termination ;
3. Like figures for fatal rinderpest ;
4. Like figures for non-fatal rinderpest ;
5. Like figures in pure trypanosomiasis ;
6. Like figures in rinderpest complicated with trypanosomiasis ;
7. Formulae in sarcosporidiosis ;
8. Formulae in other parasitic diseases ; and
9. A summary and comparative table showing the state of the blood in these infections.

MICHIELS (Fernand). **Diverses agonies due au tartre stibié.** [Toxicity of Tartar Emetic.]—*Arch. Internat. de Pharmacodynamie et de Therapie.* 1920. Vol. 25. Nos. 3–4. p. 217.*

Tartar emetic is used in increasingly large quantities throughout the tropics. It is particularly valuable in the treatment of bilharziasis, leishmaniasis, and trypanosomiasis. It is generally given intravenously. The work under consideration was undertaken at Louvain University as the result of a request by the doctors of the Belgian Congo, that investigations regarding the toxicity of the drug might be carried out with a view to obtaining knowledge whereby the occasional fatalities due to the poisoning of extra-susceptible patients undergoing antimony treatment might be avoided.

The research was carried out with the aid of rabbits, and Michiels refrains from arguing that by analogy the results so obtained therefore apply to human beings and domestic mammals. Nevertheless, the clinical experience gained in the field by veterinary surgeons at least supports such an analogy, and the effects of overdoses on rabbits resemble the toxic symptoms frequently presented by horses and cattle treated for trypanosomiasis.

The author gives a brief account of previous work by others. Very interesting are the experiments of MASOIN, who showed that antimony given intravenously disappears from the blood a minute later. Various investigators have described how, after it leaves the circulation, the drug is fixed by all the tissues, but particularly by the liver, and, to a less extent, the spleen. Elimination of the drug is by way of all secretions and excretions, but principally through the alimentary canal. This last explains the colic and diarrhoea which one meets with in practice in some animals undergoing a long course of treatment.

Administration of a *single* dose which is over the limit of safety—a dose, that is, between 1 and 2 cgm. per kilo bodyweight, causes death after some hours or even days by paralysis of the respiratory centre. The consequent dyspnoea and diminution of respiratory volume are accompanied, if the animal lives for more than a few hours, by loss of weight and general depression.

* Abstracted by Capt. H. E. Hornby, O.B.E,, D.V.S.M., M.R.C.V.S.

If one gives a lethal amount of the drug in the form of *several doses* at frequent intervals, death is brought about by hypotension due to vaso-dilatation (absence of adrenalin or paralysis of the medullary centre controlling vascular tone).

A third cause of death, which may supervene almost immediately after the injection of a toxic dose, is convulsive shock due to the poisoning at the same time of both the respiratory and vaso-motor centres.

An encouraging feature of antimony medication is the absence of drug accumulation in all cases except those to which doses approaching the toxic have been given at intervals of less than two or three days. Provided one allows an interval of not less than about three days to elapse between them, one can give for an indefinite period doses each of which is half the toxic one.

On account of this affinity of the drug for nerve centres it is difficult to prescribe an antidote for cases of poisoning by it.

Even medicinal doses cause albuminuria, but not jaundice.

After a week's heavy medication the liver may show lesions of fatty degeneration, but these are rarely severe.

SULDEY (E. W.). **Procédé simple de préparation d'un éosinate de bleu Borrel pour les colorations hématologiques.** [A Simple Method of preparing an Eosinate of "Borrel's Blue" for the Staining of Blood Preparations.]—*Bull. Soc. Path. Exot.* 1920. Mar. Vol. 13. No. 3. pp. 205–206.*

The method of preparation of this stain, which is very simple, is as follows :—

a. Mix together 100 cc. of fresh ripe Borrel's blue and 50 cc. of 1 per cent. aqueous eosin. Allow to stand for from 6 to 12 hours.

b. Filter, retaining the precipitate and allowing it to dry thoroughly in the open air.

c. Grind up the precipitate with 150 cc. of 90 per cent. or 95 per cent. alcohol ; leave open for 48 hours and agitate occasionally.

The stain is now ready for use, but should be kept in amber-coloured bottles. The dry precipitate may also be stored if a perfectly dry receptacle be used.

It may be necessary from time to time to reinforce the "basic staining" of the alcoholic solution ; this may be done by adding either one or two cubic centimetres of Borrel's blue or a mere trace of solid sodium carbonate.

The method of staining is as follows :—

a. Put three to five drops of stain on the *unfixed* blood smear and allow to act for one or two minutes, guarding meanwhile against evaporation.

b. Pour on 30 to 50 drops of water (distilled) and mix thoroughly. [This may be replaced by just shaking off the remains of the alcoholic solution and pouring on the requisite quantity of a 1 in 20 solution.] Allow to act for 10–15 minutes.

c. Wash in distilled water.

* Abstracted by Mr. S. C. J. Bennett, B.Sc., M.R.C.V.S.

Differentiation, if required, may be effected by prolonging the washing until the smear is distinctly pink in colour, or by treating as required for a few seconds with a 1 per cent. solution of tannin.

NOTE. In the absence of Borrel's blue, the carbonated blue of STEPHENS and CHRISTOPHERS may be substituted, or MANSON'S borax blue may be employed, using the latter in equal parts with the 1 per cent. eosin solution.

MOTAIS (F.) **Nouvel éosinate de méthylene.** [A New Methylene Eosinate.]—*Bull. Soc. Path. Exot.* 1920. Mar. Vol. 13. No. 3. pp. 206–8.*

This stain is produced in order to replace those of LEISHMAN and GIEMSA, which, when they are not to hand ready-made, are very difficult to reproduce. The method is as follows :—

Methylene blue ((Höchst medicinal)	1·0 gm.
Eosin (Höchst)	0·4 ,,
Methyl alcohol	40 cc.
Ethyl alcohol (absolute)	80 ,,
Glycerine	3 ,,
Fontana's ammoniacal silver nitrate solution	3 ,,

Dissolve the methylene blue and eosin in the methyl alcohol and add the absolute alcohol, and then the glycerine drop by drop. Finally, add Fontana's solution. Boil for a few minutes on a water bath, stirring continuously, allow to cool, and filter. The stain is now ready for use.

Fontana's Solution.—This is prepared by placing a quantity of a 50 per cent. aqueous solution of silver nitrate in a measuring glass and adding *liquor ammoniae* gradually, stirring meanwhile. A brown precipitate forms, which grows darker, and eventually clears up again. When it commences to re-dissolve the ammonia solution must be added very carefully. The liquid is of the required constitution when a distinct but faint opalescence is reached ; it must not become water-clear, but if by accident too much ammonia is added, one may retrieve the error by adding a few drops of silver nitrate solution and adjusting to the degree of opalescence required.

Staining Technique.—An unfixed smear is placed in a Laveran-Mesnil capsule and 15 drops of stain poured on and left for a minute. The slide is now turned face downwards and 15 cc. of distilled water added. The resulting stain is shaken slightly to mix and allowed to act for 5, 10 or 15 minutes as required. Finally, the preparation is washed and blotted and may be differentiated if required with clove oil.

By this method it is claimed that quite intensive staining is to be obtained. The stock bottle should be kept tightly stoppered owing to the extreme volatility of the methyl alcohol. Further, although dyes by Höchst are recommended, there is no reason why eosin and methylene blue from other sources should not be serviceable.

REPORTS.

RAINEY (W.). **Live-Stock Industry in Fiji.**—*Agric. Circular issued by the Department of Agriculture, Fiji.* 1920. July. Vol. 1, No. 7. pp. 119–132. 1920. Suva: Govt. Ptr.

The approximate numbers of livestock in Fiji are :—Cattle, 80,000 ; horses and mules, 10,000; sheep, 1,000; goats, 6,000 ; and pigs, 4,000. The annual birth-rate of cattle is estimated at 10,000 ; the number killed for meat or exported, 4,500 ; number of deaths from old age, disease, and Fijian slaughter 3,500 ; leaving a net annual increase of 2,000 cattle. The supply of meat at present exceeds the demand, and consequently the price to the grower is low, but there is not a sufficient excess at present to supply a large export trade. In view of the cost of clearing, cultivating, fencing and weeding, it is not profitable for Europeans, at the present price of beef, further to develop land for cattle production except as a sideline on cocoanut plantations. The supply of cattle is kept up and increased by the Indian smallholder, who, on an average, has two cows and two working bullocks. The average weight of a three to four yearold bullock in Fiji is from 300 lb. to 400 lb., and the average price per beast is £7 10s. at Suva, or £6 5s. at Lautoka. The average carrying capacity of the best flat land in the wet belt of Fiji is one beast to the acre. The only profitable form of cattle farming for the European grazier would lie in the purchase of mature cows and store bullocks from the Indians for fattening purposes. At present the only successful self-supporting grazing farms are found on river flats in the wet belt with Para grass for pasture. The scope for more graziers is therefore limited, and there is much danger from overstocking, for when this grass is eaten down weeds and worthless herbage grow in abundance. It would be difficult at present to make a success of cattle farming in the dry belt on account of the low market rate set on store cattle by the Indian smallholder and the small number of areas available for fattening without handfeeding.

The position is, therefore, that there is a fairly good opening for a few good graziers with capital, provided they can secure first-class riverside flat-ground growing Para grass in the wet belt and that so far as the profitable breeding of cattle as a self-supporting industry is concerned, there is no opening at all. It is not likely that the Islands can compete in the world's market on level terms with temperate climate countries in the export of butter. There is, however, good reason for assuming that the percentage of butter-fat in the milk obtainable from a cow is actually higher than that which could be obtained from a similar class of cow under similar conditions of feeding in temperate countries. One enterprising commercial firm has built up an important trade in the victualling of ships with fresh meat, and has in hand the experimental breeding of Indian cattle on a large scale. The great value of Para grass (*Panicum molle*), when scientifically handled, has also been experimentally established. Practically the only export trade of live animals from the Colony is the shipment of a few bullocks each month to butchers at Tonga and Samoa, and there are numerous difficulties in the way of establishing an export trade with Australia.

Remarkably small progress has been made in the cultivation of good grass. At present the only payable pasture is Para grassgrowing on alluvial land. The cultivation of Paspalum grass does not appear

to have met with success. The grasses best suited to local conditions are likely to be those of the Panicum family. With the exception of a small-leafed trefoil, Para grass, Guinea grass, and an upland variety of Panicum in the dry belt, there appear to be no grasses growing and propagating naturally in Fiji that are worth cultivating. Buffalo grass has been introduced experimentally and appears to do well. Rhodes grass is also being tried. Sensitive grass is useful in some places as a supplementary feed, but in other places cattle refuse to eat it.

As the result of Rainey's investigations, the following proposals have already been given effect, viz. :—

(*a*) An Ordinance to regulate the transport of cattle by water.

(*b*) An Order in Council making adequate regulations under the Foreign Animals Importation Ordinance to safeguard the Colony against the introduction of animal diseases.

(*c*) Regulations for the humane slaughtering of cattle.

(*d*) The declaration of tuberculosis as a contagious and infectious disease of cattle.

(*e*) Arrangements for establishing a quarantine station for animals at Suva.

Proposals which may require new legislation, to which effect has not yet been given are, :—

(*a*) An Ordinance to regulate the Overland Transit of Cattle; persons intending to travel cattle overland from one district to another should be compelled to obtain from the police a waybill, which would be checked and countersigned at each police station *en route*. This Ordinance would avoid any confusion that might arise concerning the identity of the travelling cattle and other animals, the property of persons on the trade routes.

(*b*) An Ordinance to provide for the Registration, etc., of Proprietors of Gates (large areas of foot-hill land appropriated for native cattle runs). The owner of the Gate receives cattle as boarders on payment and the object of the Ordinance is to prevent fraud.

Certain proposals are made which may require the amendment of existing legislation and regulations :—

(*a*) In Ordinance No. 21 of 1909 (Stock Improvement Ordinance of 1909), it is recommended to delete all reference to bulls, as at present there is no sound reason for selecting bulls by enforcing castration and it is not practicable at present to establish State-owned bulls for the use of the public.

(*b*) Importation of cattle from New South Wales, Victoria, and South Australia, ought to be sanctioned in the case of pure-bred breeding stock, provided they are submitted to veterinary inspection on arrival, quarantined for 14 days, and sprayed twice at intervals of 10 days during that period with a reliable arsenical dip.

(*c*) Infection of dogs with *Filaria immitis* should be declared an infectious and contagious disease under the Contagious Diseases (Animals) Ordinance, in order to give the Government Veterinary Officer power to destroy badly affected animals in the later stages of the disease.

(*d*) The Government should bear the cost of sea freight in respect of pure bred entire horses, cattle, and sheep, imported for *bona fide* breeding purposes. Pure bred cattle from India and jack asses from Spain should be included.

(*e*) The maximum compensation for the slaughter of a diseased beast should not exceed £3.

Proposals, which may not require legislation, are made (*a*) with reference to the appointment of a second veterinary officer for duty at Lautoka, and (*b*) having in mind the mortality that occurred in Mauritius, due to the importation of surra-infected animals from India, imported Indian cattle should be very carefully observed, and a dog should be inoculated with blood from each imported animal as soon as convenient after landing.

(*c*) All cattle should be inspected annually and infected herds inspected quarterly; all animals showing clinical symptoms of tuberculosis should be slaughtered.

(*d*) Every encouragement should be given to the promotion of agricultural shows or exhibitions of live stock.

In former reports certain proposals were made, but the author now adduces reasons for the abandonment of these proposals. Among these are those having regard to (1) the establishment of Government-owned bulls and stallions at various centres for the use of the public; (2) the establishment of a Government Stud Farm or Stock Farm for breeding pedigree stock; (3) the administration of the Stock Improvement Ordinance of 1909 by means of Committees in Districts; and, (4) the appointment of part-time lay stock inspectors in the country districts.

Animal Diseases.

Tuberculosis.—This disease is found in cattle throughout the Islands, and the degree of infection is favoured particularly in those districts where there is shade of trees and dense herbage, heavy rainfall, neglect in destroying diseased animals, overstocking or close stocking, and herding in large numbers. It is estimated that the incidence varies from 2 per cent. in some parts of the dry belt to 20 per cent., in some parts of the wet belt. Certain herds that have been neglected show a considerably higher percentage. In the wet belt the disease affects chiefly the lungs; in the dry belt it runs a more chronic course and is often found affecting the pharyngeal, prescapular, precrural, and inguinal glands, the udder rarely, and the subcutaneous tissue of the brisket. Little trouble is anticipated in controlling the disease among cattle on Indian smallholdings, as the Indian smallholder zealously prevents his cattle from running with those of his neighbour.

Nodular worm disease.—This affection appears to be distributed everywhere throughout the Colony and its ill effects appear to be limited to the following circumstances:—(1) it may give the final blow to overstocked, emaciated, or very weak animals; (2) it causes a chronic diarrhoea in badly affected animals so that they cannot be fattened; and (3) it is unable to obtain a hold on healthy, well nourished animals.

Ulcerating tumours of the eye and back of cattle and legs of horses.—An account of this condition appears to have been furnished in a previous report by the author, and he now adds "that further investigation may show the exciting cause to be a larval nematode worm, thereby establishing a relationship to a similar condition in Samoa termed 'Tona.'" The Government Veterinary Bacteriologist of New Zealand, Reid (H. E.), in a recent report on a visit to Samoa,

stated that " Tona " is due to wound infection with the larva of a parasitic worm [apparently Habronema, the larval form of which is now held to be the cause of summer sores, bursati sores, habronemic granulomata, etc.—ED.].

A few cases of actinomycosis in cattle have been observed.

Horses bred from Clydesdale or Shire strains are susceptible to greasy legs.

Strangles is introduced from time to time in shipments of horses from Australia and New Zealand, and its incidence appears to be limited by the extent of infection from this source. It does not tend to become enzootic in Fiji, or to cause serious symptoms in infected animals. Consequently it suffices to apply quarantine restrictions only to actually diseased animals arriving by sea.

Filariasis of dogs.—This disease is distributed everywhere throughout the group. It has been suggested that an island situated as Taveuni is, might free itself for some time from the disease by (1) destroying on a given date all the dogs on the island and forbidding the landing of any dogs from any Pacific Islands thenceforth ; (2) restocking the island, after six months, with dogs imported from New Zealand or Australia. It is thought likely that during the interval of six months all the insect life on Taveuni carrying infection would become clean, and that the Island might remain free from the infection for a considerable period. However, on the other hand, it is possible that clouds of mosquitoes might be carried by certain winds from other islands and cause failure. At all events a considerable degree of success is likely to attend such a measure, for even although a few mosquitoes might be introduced from time to time with ships, the filaria would not be readily re-established in this manner. Individual dogs may be kept free from the disease by protecting them from mosquito attack in various ways, but few people are likely to take the trouble to ensure the success of such a measure. Many fantastic views are current in Fiji regarding the alleged virtues of several remedies as the destroyers of *Filaria immitis* in dogs. It is pointed out that recent research work carried out in Queensland by direction of the Australian Institute of Tropical Medicine has proved that the worm may be conveyed from one dog to another by the agency of fleas. In order to protect dogs with certainty, however, it would be necessary not only to make their sleeping quarters mosquito proof but also to keep the animals free from fleas by dusting them regularly with pyrethrum powder and periodically washing the kennel with a solution of corrosive sublimate, 1 in 300.

Mange.—Appears to be found only affecting horses in the dry belt, and it seems to be only slightly contagious as compared with the disease in other countries. Consequently there should be no great difficulty in stamping it out.

Scour in calves.—This disease is limited to areas and herds where the feeding arrangements are inadequate or where the land is overstocked.

Osteoporosis in horses.—Is found affecting a considerable proportion of all horses that have been running on Para grass from the time when they were foals, and the incidence of the disease is absolutely restricted to such circumstances. The naked eye symptoms are usually a bulging enlargement of the bones of the face and a general appearance of unthriftiness. In more advanced cases there is stiffness of gait or even paralysis of one or more legs. " There are few diseases of which

the cause has been more disputed, but it seems proved that the form of the affection in Fiji is due to a deficiency in Para grass growing on alluvial flats of some element required for the growth and maintenance of bone in horses. This element may be lime or it may be a vitamin . . . . in practice the disease may be prevented by feeding a daily ration of cow-pea to each young horse running on Para grass. A ration of molasses also acts as a preventive."

Debility and malnutrition of cattle.—These conditions are widespread in Fiji and are the inevitable result of overstocking, underfeeding and running cattle on land where the pasture has little feeding value. The immediate effect is emaciation, but the ultimate result is the degeneration and dwarfing of all stock subjected to this circumstance. The Stock Improvement Ordinance of 1909 was passed, in so far as it provided for the castration of bulls, on the assumption that lack of attention to the matter of breeding was chiefly responsible for the degeneration of cattle, but Rainey's investigations appear to prove that under-feeding is by far the most important factor.

The future of the cattle trade in Fiji depends upon the following factors :—

1. Practical demonstration on a sufficient scale that hill land in the wet belt of Fiji will produce permanent pasture that will pay for weeding.
2. The discovery of suitable grasses for upland pasture.
3. In proportion to the grazing value of certain lands the cost of clearing, fencing, planting, and draining those lands and keeping them free from *Clidemia hirta* and other noxious weeds.
4. The establishing of a remunerative opening by means of a freezing or canning factory whereby Fiji may have access to the world's markets.
5. Creation and improvement of roads.
6. The amount of suitable land in fair sized lots conveniently situated as regards means of communication, which will be readily available for sale or long lease to intending graziers at reasonable cost.
7. The practicability ultimately of applying a Noxious Weed Ordinance to *Clidemia hirta*.

For a proper understanding of the pastoral problems of Fiji as compared with Australia, it must be realised that cattle ranching on a free and easy ring-fence or a boundary-riding basis is quite impossible. Large areas of good natural grazing, which make big scale ranching profitable in other countries are not found in Fiji. Dangerous bog, impenetrable forest, sterile hill land, entirely innutritious grasses, and other adverse features are inseparable from any considerable stretch of country in Fiji. It has to be noted, however, that these Islands are remarkably free from cattle diseases, and the author is convinced that under proper conditions of feeding and farming generally, cattle will thrive as well in Fiji as in any other country. A cross between the Zebu (Indian ox) and a European strain of cattle is most likely to prove the best breed for Fiji, except for high grade dairy farming, for which purpose a pure strain of Holstein is likely to give the best results. The half bred zebus have certain advantages in a tropical country inasmuch as they make by far the best working oxen, and are much more resistant to disease and better able to withstand adverse conditions of care and feeding than other

breeds. The dry belt, although it affords no hope of further development for cattle, still holds forth good prospect of development as a sheep country, but further investigation is needed to establish whether ewes are profitably fertile in Fiji. The commercial prospects of pig-production could not be ascertained. Much hope of success is anticipated from the Dairy Scheme which has been established in Tailevu.

As regards horses, it is considered that Fiji can supply herself with both horses and mules provided reasonable care is observed in the breeding and feeding of foals. Draft horses are chiefly in demand, and these should be bred from the Suffolk Punch or Percheron strains. The best pasture for horses is the trefoil and mixed herbage found in the mountain valleys and some uplands in the dry belt. However, it may be found on examining all the circumstances that it does not pay to breed horses in Fiji when a great horse-breeding country like Australia is near at hand and ready to supply any number of animals at a moderate price. On the other hand it ought to pay well to breed mules, which could be done very well by mating good imported jack asses with good country bred mares, and these animals are deemed to be the more suitable for the conditions of plantation work.

EGYPT. **Ministry of Agriculture, Veterinary Service, Annual Report for the Year 1918–1919.** [LITTLEWOOD (W. L.), Director]. 39 pp. 1920. Cairo: Govt. Press. Price: pt. 5.

This report is divided into three sections dealing respectively—(1) with contagious diseases, (2) the veterinary pathological laboratory, and (3) the school of veterinary medicine.

CONTAGIOUS DISEASES.

Cattle plague and double inoculation.—During the year there were 873 deaths from cattle plague reported in two Governates and 14 Provinces. This brings the total number of registered deaths reported in Egypt since the reappearance of the disease in June 1903 to 182,332. The death rate from natural infection amounted to 0·08 per cent., as against 0·43 per cent. in the preceding year. In addition, 654 cases were detected amongst cattle imported from the Soudan in the various quarantine pens and Cairo abattoir. During the preceding year 4,680 deaths were reported in the Interior and 527 cases were detected among cattle imported from the Sudan. 40,301 cattle were actively immunized in 1918–19 with 189 deaths, following upon the double inoculation. Of this number 4,361 were inoculated at the request of their owners upon payment.

On 24th August 1918 five bulls of the Domains Administration that had been immunized by this method six years and two months previously, were given 5 cc. each of virulent rinderpest blood. No reactions or departure from the normal in condition were subsequently noticed. Of these five bulls two had reacted and three had not reacted when inoculated in June, 1912.

On 27th October 1918, 10 bulls of this Administration that had been immunized by the double inoculation in June 1912, were given 5 cc. each of virulent blood; four had reacted and six had not reacted to the first inoculation. The bulls were then placed under careful observation for 15 days and during this time there were no reactions produced or any visible sign of illness.

On the same day a control Cyprus bull was inoculated with the same blood and it developed rinderpest. This experiment would appear to indicate that a very durable immunity existed in these cattle, which had lasted six years and four months, and then showed no sign of weakening.

The actual stock of anti-rinderpest serum amounted to 79,438·5 units of 50 cc. Egyptian and 57,472 units of 50 cc. Indian serum on 31st March, 1919. The Egyptian serum was found to have lost its protective power owing to age, as it had been stored since 1915. It was therefore condemned and destroyed.

Rabies.—Ninety-seven cases reported (86 dogs, 5 cats, 5 wolves, 2 donkeys), as compared with 117 in the previous year. The cases were reported in four Governates and 13 Provinces. 4,759 dogs in all were seized in Cairo and sent by the Police to the Dogs' Home, most of them being destroyed unclaimed. In addition the police destroyed during the year 3,767 dogs and 5,622 cats in Cairo and its suburbs; 3,162 dogs and cats were seized in Alexandria. In Cairo 165 dogs, 7 cats, 6 monkeys, 2 foxes, 1 mule, and 10 horses were placed under observation as they had bitten persons. In all cases of outbreaks of rabies and in cases of suspicion a certain number of dogs in the villages were destroyed in order to prevent the disease extending; hence in the Mudiriyas and Governates 42,508 dogs and cats were poisoned.

Glanders.—Sixty-one cases were detected in four Governates and four Provinces, as against 41 cases in the preceding year. 4,125 animals were tested with mallein in Egypt.

Epizootic lymphangitis.—Six cases reported, as against 18 in the previous year, in the Cairo and Alexandria Governates.

Anthrax.—Fourteen cases reported (1 donkey, 3 camels, 1 bull and 9 sheep).

Sheep pox.—823 cases reported, most of these being Sudanese sheep as against 296 in the previous year.

Foot-and-mouth disease.—No cases reported. In the previous year 181 cases were reported, all in Sudanese animals.

Haemorrhagic septicaemia.—Twenty-four cases in cattle, buffaloes, and sheep, against 98 cases in the previous year; these occurred in one Governate and six Provinces. This disease is very common in Egypt and the Director is of the opinion that the losses are much greater than those notified. Preventive serum was used in several outbreaks; 1,266 animals were injected with serum with satisfactory results. A large loss might be avoided if this disease was notified early.

Mange.—943 cases, mostly in imported Sudanese sheep. In connection with several S.P.C.A. in the Mudiriyas 1,608 camels were treated for mange. The necessary drugs were issued by the Service against payment.

Strangles.—Forty-one cases, against 91 cases in the previous year, in one Governate and five Provinces.

Spirochaetosis in Fowls.—One case only reported in a hen, against five in the previous year.

Trypanosomiasis.—One case only reported in an imported Sudanese bull, against 149 in the previous year.

Filariasis.—No cases reported; in the previous year 77 cases were reported.

Piroplasmosis in Egyptian Animals.—Eighty-seven cases detected (86 in cattle and 1 in a horse) in one Governate and 10 Provinces. Ten of these animals had been imported from Cyprus. Of these 47 cattle died or were slaughtered and 39 cattle and one horse recovered. In the previous year 105 cases were reported. The disease is very common in Egypt and much might be done to save the lives and usefulness of cattle if veterinary advice were sought for. Destruction of ticks infesting cattle by spraying with an arsenical preparation has during the last three years been carried out in order to prevent the disease. Owners of cattle now appreciate its usefulness and during the year, 3,325 cattle were sprayed against payment.

Piroplasmosis in Sudanese Animals.—Ninety-six cases reported (92 cattle and four sheep). These occurred in the Shellal and Cairo quarantine pens; all died or were slaughtered. In the previous year 38 cases were reported.

Tuberculosis.—3,524 cases reported, detected almost entirely in the Cairo and Alexandria abattoirs. This would indicate that 5·21 per cent. of the number slaughtered were affected with tuberculosis, as diagnosed by post-mortem examination. 2,210 cattle belonging to the Domains Administration were tested with tuberculin and of this number 963 gave positive results (43·5 per cent). One must therefore conclude that a large number of Egyptian animals are affected with tuberculosis.

Tetanus.—Eleven cases reported against 21 cases in the previous year, distributed in one Governate and six Provinces.

Ovine Caseous Lymphadenitis.—No cases detected. Three cases reported in the previous year.

Coccidiosis.—Fifty-eight cases detected (almost entirely in imported Sudanese animals) against 27 in the previous year.

Contagious Bovine Pleuro-pneumonia.—Thirty-six cases detected, all animals imported from the Sudan. In the previous year 211 cases in were detected.

Stiff Sickness.—During the year five cases only were reported, against one case in the previous year. The disease has become prevalent, but as it assumed a mild form very little notice was taken of it and cases were not reported.

Bursati.—Four cases reported (two mules and two donkeys); no cases reported in the previous year.

Cow Pox.—No cases; seven reported in the previous year.

Camel Pox.—One case detected, against 38 cases in the previous year.

Fowl Diphtheria.—One outbreak reported; 25 cases reported in the previous year.

Fowl Plague.—130 cases reported, against 72 cases in the previous year.

Fowl Cholera.—Four cases reported; none reported in previous year.

Actinomycosis.—One case only detected; against 26 cases in the previous year.

Malta Fever.—Eight cases detected in the Canal Governate against 50 cases in the same Governate in the previous year.

Swine Plague.—Nine cases reported. No cases reported in previous year.

Sudan Trade.—35,310 cattle and 204,627 sheep and goats were imported from the Sudan during the year, an increase of 6,282 cattle and 62,494 sheep and goats. Most of these animals passed through the Shellal quarantine station and figures are given concerning the number of animals and hides that passed through this station. Two bales of skins were imported from the Soudan via Suez for transhipment to foreign countries during the year, against 61 bales during the previous year.

Besides animals imported from the Sudan 180 cattle and buffaloes, 44 mules and donkeys, 5,984 sheep and goats, 822 pigs, and 21 camels were imported from other sources. The total number of imports during the year was 246,988, against 184,418 in the previous year.

Statistics are given regarding the isolation hospital for contagious diseases of animals, Abbasiya. The total number treated was 290 (mange being the chief disease observed, 230 cases), others consisting of glanders, epizootic lymphangitis, rabies, lousiness, and eczema.

The animal population of Egypt is now as follows: horses, 30,390; mules, 14,929; donkeys, 583,304; camels, 103,631; pigs, 18,929; sheep, 854,380; goats, 230,617.

718,920 animals were slaughtered in the public abattoirs, against 683,724 in the previous year. No frozen meat was imported by British firms as all Australian frozen meat was purchased by the British Government as in the previous year.

The number of veterinary legal cases showed a marked decrease.

Veterinary Pathological Laboratory [MASON (F. Eugene), Sub-Director and Pathologist in Charge.]

A large number of interesting specimens were examined at the laboratory both from the Egyptian veterinary service and from Army sources. An investigation into a serious mortality in equines proved the condition to be "enzootic equine paraplegia." A vaccine was prepared which, it is stated, gave satisfactory results. Experiments were conducted in an endeavour to find a satisfactory material of local origin for the treatment of mange in camels with a view to rendering the country in this particular respect independent of imported sulphur and oil. "Entirely successful results were obtained with colocynth tar." [For investigations into the properties of this substance in the treatment of camel mange *see* this *Bulletin*, 1919, June, Vol. 7, No. 2, p. 64 (SERGENT and LHÉRITIER); 1920, June, Vol. 8. No. 2, p. 138 (MUSSO), experiments at the Pasteur Institute, Algeria; and 1920, Dec., Vol. 8, No. 4, p. 308 (DONATIEN), Algeria.—ED.]

Investigations, which have not yet been completed, were conducted on rinderpest with very promising results. The high mortality in imported Cyprus goats was successfully investigated. Experiments were made upon the curative treatment of epizootic lymphangitis and successful results are claimed to have been obtained with novarsenobenzol provided the subjects were not advanced in age.

Investigations into the cause of high mortality in imported Sudanese sheep at Shellal, Cairo, and Qantara proved the disease to be coccidiosis.

School of Veterinary Medicine [RABAGLIATA (D. S.), Director]. Some remarks are written by Rabagliata on this school, in which there were 29 students on the books on 1st April. Four students obtained their diplomas in February, 1919. Considerable progress has been made with the plans of the new school at Giza and it was

anticipated that the October session would open with the school installed in the commodious temporary premises lent by the Director of the School of Agriculture at Giza. With the return of the members of the staff who had been on active service and under new and better conditions it was anticipated that a new and successful era in veterinary teaching would be commenced in Egypt.

The report concludes with a number of tables giving a census of the animal population and slaughterhouse statistics.

NYASALAND PROTECTORATE. **Annual Report, Department of Agriculture for the Year ended March 31, 1920. Report Veterinary Division.** [GRIFFITHS (J. A.), Senior Veterinary Officer.] pp. 8–10 f'cap. 1920. Zomba: Govt. Ptr.

Rinderpest. The present situation is considered to be quite satisfactory. The operations of the Rinderpest Commission resulted in the formation of an " immune belt " in Tanganyika Territory between Lakes Nyasa and Tanganyika wherein all the cattle were immunized during 1917 and 1918. To the south of this there is a belt of country between the Lakes which is clear of all cattle. In Nyasaland, to the south of the cattle-free belt, there is a controlled area in which the cattle are registered, births and deaths are recorded, and movements of cattle are only allowed under permits issued by the veterinary staff in this area. Reports from Tanganyika Territory do not indicate that there is any rinderpest in the districts immediately to the north of the immune belt.

No outbreak of East Coast Fever has occurred outside the areas in which it is enzootic. It has not been possible to define the full extent of these areas and to carry out the recommendations for eradicating the disease owing to the shortage of veterinary staff.

In areas settled by Europeans there has been very little trouble from other tick-borne diseases except where dipping has been neglected. More dipping tanks are being built every year so that very soon it will be possible for most cattle owners to have a dipping tank available within a reasonable distance.

A few cases of demodectic mange occurred among cattle in the Blantyre District and all the affected animals were slaughtered.

Outbreaks of trypanosomiasis have occurred among cattle in various parts of the Shire Highlands; the disease was also very prevalent on the Namiwawa Stream to the south of Zomba, and cases were diagnosed outside Blantyre and at Mikalongwe, Mlanje, Malosa, and Kota-Kota. The sick animals at the last two places had been previously brought through tsetse belts, but in the other outbreaks there was no such history. In the Government Farm at Namiwawa the disease has occurred sporadically among work oxen for several years, in spite of the fact that animals found on microscopic examination of the blood to be infected are eliminated by slaughter. Several animals that were born on the farm became infected during the year, and as there are no tsetse on or near the farm or grazing areas the disease must have been transmitted by blood-sucking flies other than tsetse. Drug treatment was found to be of value in all cases where the animal had not reached the advanced stages of the disease. Treatment prolonged life and improved the general condition to such an extent that when combined with good feeding the animals could be slaughtered for food, while in about 60 per cent. of the favourable cases the animals were able to resume work. In advanced cases,

where the animal had become weak or emaciated it either could not withstand treatment or derived no benefit from it.

A fairly considerable number of deaths occurred among cattle with gastro-enteritis as the most prominent characteristic. This condition was attributed to various causes, viz. :—

1. Arsenical poisoning, due to the animals swallowing dipping solutions. Very few cases that showed signs of abdominal pain recovered.

2. Coccidiosis. This is now described for the first time in Nyasaland and it was found to be the cause of heavy losses at Mikalongwe, and several outbreaks in small herds in the Zomba and Blantyre districts.

3. Poisonous plants. A fairly common cause of gastro-enteritis towards the end of the dry season, and at the beginning of the rains. Various poisonous plants are incriminated, together with over-feeding on the fresh flush of young green grass after the first rains.

4. Parasites. Round worms in calves occasioned heavy losses throughout the Shire Highlands.

Losses occurred amongst cattle due to liver fluke invasion, especially when the infected animals had had to undergo long journeys or had their recuperative powers depressed by other causes. Infestation with this parasite was most commonly noted in the Ncheu District.

The most common diseases of sheep were :—

1. Distomiasis, due to infestation of the liver with *Fasciola gigantica* ; this caused losses among European-owned sheep in the Zomba District.

2. Tapeworms, which invested the bile ducts as well as the intestines. This condition was a very common cause of poverty in sheep throughout the Highlands.

3. Contagious pneumonia. Caused an outbreak with high mortality in a small flock on the Government Farm at Namiwawa.

4. Grass poisoning. Stated to have caused heavy losses on the Ndindi Marsh, Port Herald District ; the animals were poisoned by feeding on fermenting vegetation and young green grasses as the water subsided after the floods.

Pseudo-rabies of the Dog. There appears to be a disease of dogs and cats in Nyasaland which clinically closely resembles true rabies in all its symptoms. It is apparently transmitted by the bite of an infected dog to a healthy dog or cat. In six cases which came under observation there was a history of the animal having been bitten by an apparently rabid stray native dog about a fortnight before any symptoms were seen. The first symptoms were uneasiness, apparent difficulty in swallowing, and in some cases dribbling of saliva from the corners of the mouth. There was a general hyper-sensitive condition, twitching of the muscles, and a loss of co-ordination of the limbs so that the animal walked in an aimless fashion. As the condition progressed, the animal, which apparently never slept, sometimes kept up at intervals a peculiar wailing cry, and in the later stages snapped at imaginary objects. In the observed cases death occurred in from two to seven days from the onset of symptoms. Paralysis of the muscles concerned in swallowing in some cases gave rise to the belief that the trouble was due to some foreign body in the mouth or throat. Post-mortem there was stated to be congestion of the cerebro-spinal vessels, and the stomach in every case contained various foreign bodies.

In Nyasaland there appears to be no case on record of any human being having contracted rabies from the bite of a dog, and the only case of a positive reaction to the biological test for rabies is one recorded by GARDEN (G.) in 1916. [Compare observations in West Africa, p. 173 of this Bulletin, (TEPPAZ and BOUFFARD).]

During the year 18 breeding bulls and 164 breeding cows were imported, together with 252 head of slaughter stock and trek oxen, and 23 pigs, 10 dogs and 1 donkey. Some of these were imported from England.

The work of the Veterinary Department was confined to dealing with outbreaks of contagious disease in southern districts and there was no time available for undertaking special research work on the problems of local diseases. There is very urgent need for a research laboratory. With the development of the country, stock of all kinds has increased from 100 to 200 per cent. in market value, with the result that demands on the veterinary services are considerably increased. The diseases which require special investigation are stated to be coccidiosis, trypanosomiasis, plant poisons, various diseases caused by parasites, pseudo-rabies in the dog, and the pernicious anaemia of cattle which is a cause of losses in the Blantyre and Zomba districts.

GOLD COAST. **Report of the Veterinary Department for the Year 1919.** [BEAL (W. P. B.), Veterinary Officer.] 12 pp., f'cap, 1920, Gold Coast: Govt. Press, Accra.

General routine work was carried out as in previous years at Coomassie and on tours of inspection. No investigation or experimental work on animal diseases was undertaken during the year.

In this connection it is interesting to note that an important monograph entitled "Report on the Live Stock Industries of the Northern Territories of the Gold Coast Colony" has been published recently by BEAL [an extract will be found in this *Bulletin*, 1921, Vol. 9, No. 1, p. 36).

Some thousands of cattle are imported into the Gold Coast by land, the chief sources of supply being the French markets in Upper Senegal and Niger and neighbouring territories. The principal ports of entry into the Northern Territories are Bawku and Navarro, and a small number enter at Tumu. 29,539 cattle were registered at the first two centres and 3,634 at Tumu and other places on the frontier of the North-western Province. The number of cattle passing into and through this Province has decreased considerably, largely because the French authorities wish to conserve the supply of cattle for their abattoirs at Lydianne and Bamako. The cattle that enter at Bawku finally make their way to different parts of east and central Ashanti and to the Eastern Province of the Colony, while most of those registered at Navarro go to different parts of western and central Ashanti. No correct record of the cattle trade in Ashanti is known, but cattle trade in Coomassie is in a bad state, for the market is not a popular one with up-country importers, due to the long credit system and English currency notes, which are of little use in the French Soudan. The average price per head of cattle in this market was £10, but owing to a shortage of French currency notes towards the end of the year prices more than doubled. The number of imported cattle presented at Coomassie was 6,915, a decrease of 3,983 head from that imported in 1918. Of this number 15 head were stopped and died in detention,

four from trypanosomiasis, three from rinderpest, and eight from pneumonia. The number of cattle passed for exportation by railway from Coomassie was 2,263 head, together with 1,170 sheep and 320 goats. The local trade in cattle hides was 13,780, a decrease of 20,861 on the year 1918. The great decrease in the trade of hides coincides with the great decrease in the number of cattle imported into Ashanti. Cases of mange were noted in dogs, sheep, and goats in Coomassie town and the affected animals were killed.

Details are added concerning the live stock farm at Coomassie, where a small herd of cattle is kept for breeding purposes. The information gathered on the tours of inspection has been alluded to largely in the report mentioned above.

Contagious diseases.—Anthrax is enzootic in the country and outbreaks and sporadic cases occur chiefly in the low-lying breeding areas. There is no doubt, it is stated, that many cattle and sheep contract the disease in a mild form and recover.

Contagious bovine-pleuro-pneumonia is also enzootic and several cases were encountered in the north-eastern Province of the Northern Territories.

Epizootic lymphangitis in horses appears to be widespread, and contagious foot rot of cattle and sheep is an important condition and has to be distinguished from foot-and-mouth disease.

From reports received it appears likely that infectious anaemia of horses is prevalent in the country. Cases of filarial infection were met with in horses and blood smears of cattle frequently showed unsheathed filaria embryos. An outbreak of fowl cholera was encountered. Blood smears prepared from slaughtered cattle frequently showed *Th. mutans*. No Koch's bodies have yet been discovered in these animals and no cases of *B. bigemina* infection were seen. Rinderpest was not observed on the tour of inspection, but cases were seen at Coomassie in imported cattle. Haemorrhagic septicaemia in cattle, spirochaetosis in fowls, and strangles in horses were seen. There were no facts of importance to add in connection with trypanosomiasis. Several new tsetse fly areas have been mapped out and a few specimens of *G. morsitans* and *G. tachinoides* were collected. *Haemonchus contortus* causes a very high rate of mortality in sheep. Some experiments were conducted on the production of good grazing grass.

Report of the Committee on the Staffing of the Veterinary Departments in the Colonies and Protectorates. 10 pp., f'cap., 1920. London: H.M. Stationery Office. Cmd. 922. Price 2*d.* net.

The Committee appointed by the Secretary of State for the Colonies to consider the staffing of the Veterinary Departments in the Colonies and Protectorates consisted of:—

Sir Herbert J. READ, K.C.M.G., C.B., Assistant Under-Secretary, Colonial Office (*Chairman*).

Sir John MCFADYEAN, M.B., B.Sc., M.R.C.V.S., LL.D., Principal of the Royal Veterinary College, London.

Sir Stewart STOCKMAN, M.R.C.V.S., Chief Veterinary Advisor to the Ministry of Agriculture.

The President of the Royal College of Veterinary Surgeons.

Professor O. Charnock BRADLEY, M.D., D.Sc., M.R.C.V.S., Principal of the Royal (Dick) Veterinary College, Edinburgh.

Professor J. Share JONES, D.V.Sc., M.Sc., F.R.C.V.S., Director of Veterinary Education and Professor of Veterinary Anatomy in the University of Liverpool.

Major R. D. FURSE, D.S.O., Assistant Private Secretary (Appointments), Colonial Office.

The terms of reference were :—

(*a*) To consider whether the Staffs of the Veterinary Departments in the various Colonies and Protectorates are adequate, and, if necessary to recommend increases of staff ;

(*b*) To consider whether the rates of salary offered to the Veterinary Staffs are adequate, and, if necessary, to suggest improvements ;

(*c*) To make recommendations for improving the arrangements for recruiting Veterinary Staffs for the Colonies and Protectorates.

With regard to the first and second terms of reference the Committee recommended a considerable increase in personnel as well as an appreciable improvement in the salaries to be offered to the veterinary staffs in several cases, viz. : East Africa (East Africa Protectorate, Uganda, Nyasaland), and West Africa (Gold Coast, Sierra Leone, Gambia), Cyprus, and Fiji. No revision was considered necessary in certain Colonies, viz. : Zanzibar, Straits Settlements, Federated Malay States, Mauritius, Trinidad, Bermuda and Barbados, and the Falkland Islands.

The situation in Nigeria, the Tanganyika Territory, and the Windward Islands with regard to veterinary matters is stated to be the subject of correspondence between the Secretary of State and the local Governments. The cases of Nigeria and the Windward Islands (with the exception of St. Lucia) were not considered further pending the issue of the correspondence. As regards the Tanganyika territory, proposals were awaited from the Administrator with reference to the establishment of a permanent Veterinary Department, but the Committee recommended that in the grading of the personnel and the provision of appropriate salaries the principle should be observed of securing as great a degree of uniformity as possible between this territory and the Protectorates of eastern Africa. In the case of Ceylon, British Guiana, Jamaica, and the Leeward Islands, the information available concerning the present situation, and further possibilities with respect of veterinary matters was not considered sufficiently detailed to enable the Committee to determine whether the existing veterinary staffs were adequate to carry on the work or whether they received suitable salaries.

Where increases in personnel and pay were recommended, particularly in the case of the East Africa Protectorate, the Committee considered that the veterinary staffs in these places were inadequate to cope with the work demanded of them. It was confidently anticipated that the additional expense involved by the adoption of the proposals would be amply recompensed by the results. The importance of the stock industry to East Africa, it is stated, has not hitherto been recognized and the Committee wish to associate themselves cordially with the views of Major-General Sir E. NORTHEY, who regards cattle rearing as the paramount industry of the Protectorate which he governs. The prosperity of the Protectorate is largely therefore bound up with the wellbeing of its animal population, and the Government ought to provide a Veterinary Department sufficiently strong to ensure the competent care and supervision of the country's live stock. In the process of general readjustment following on the war, and perhaps as the result of the land settlement

scheme organized by the Government for ex-service men, the East Africa Protectorate will in all likelihood take rapid strides forward towards the future predicted for it as a settlers' country. Should this hope be realized, it will in all probability follow that the country's teeming herds will steadily multiply in number beyond the present total of 2,000,000 head which now grazes on the pastures from Kenya to Kapiti, on the Uasin Gishu plateau and the uplands round Londiani. It would be well, therefore, that the Veterinary Department, while organizing its resources for a more effective campaign against cattle disease, should at the same time make ready to face an expansion of work.

The same considerations are held to be applicable to the Tanganyika Territory and Uganda. A particular feature of the position of Uganda is that very many of the diseases which are rife amongst the live stock of East Africa originated in that Protectorate. It is thus of supreme importance to the whole of East Africa that the Veterinary Department of Uganda should be strong enough and sufficiently well equipped to cope with these scourges as soon as an outbreak is threatened and thus to check the evil at its source.

To improve the condition of the live stock in East Africa and to maintain it at a higher standard, to eradicate as far as possible the diseases now prevalent, and to guard against their recurrence, to stimulate and encourage the cattle rearing industry, and so to assist in advancing the prosperity of our East African dependencies are objects which call for the most earnest consideration. The only practical measure for improving the arrangements for recruiting veterinary staffs in present circumstances, is, in the Committee's opinion, to offer the improved rates of salary recommended. The shortage of qualified veterinary surgeons, which was already pronounced before the war, has become accentuated by the interruption which the war caused in the course of studies for the veterinary diploma. Until those students who have entered the veterinary colleges subsequently to their release from military duties have completed their studies, it is inevitable that the number of men from whom the veterinary staffs can be recruited will continue to be very limited. So long as these abnormal conditions prevail, the means adopted to recruit veterinary personnel must necessarily take the form of *ad hoc* measures devised to meet special local requirements or to combat particular emergencies. New posts should be filled by selection of suitable officers as soon as circumstances may permit.

In nearly all the Colonies and Protectorates which the Committee considered, the veterinary departments are at present branches of the agricultural departments, and it is recommended that in future veterinary and agricultural work should be regarded as distinct and that the veterinary interests be entrusted to separate veterinary departments. The Committee further dwells upon the grounds for recommending the increases of salary and also re-emphasizes the importance of continuity of service in veterinary departments. With a view to offering brighter prospects of promotion and advancement to the members of the small veterinary departments, it is recommended that, where possible, a system should be introduced whereby the staffs of neighbouring Colonies and Protectorates would be interchangeable. This would secure to all officers of those departments the prospect of rising to higher and more responsible positions, wherein not only would the remuneration be greater but the work also would be more scientifically valuable.

A further question was considered, viz. : that of the appointment of a Director of Veterinary Research and Administration for the coterminous territories of East Africa, Uganda and Tanganyika. The Committee was not unanimous on the practicability of combining in the hands of a single Director the responsibility both for administration and for research over so vast an area, but they agreed that results beneficial to all three territories would accrue from the institution of some form of supreme authority which should guide the direction of research into the most fruitful channels, and co-ordinate to their combined advantage the administrative work of neighbouring veterinary departments all engaged in the handling of common tasks and the solution of similar problems.

The report is signed by all the members of the Committee.

RECUEIL DE MÉDECINE VÉTÉRINAIRE. 1921. July 15. Vol. 97. No. 13. pp. 387–395. **Procès-verbaux sommaires de la Conférence internationale pour l'étude des épizooties, réunie à Paris du 24 au 28 mai 1921.** [A Summary of the Minutes of the International Conference for the Study of Epizootics held in Paris from the 24–28th May 1921.]

The decision to hold an International Conference for the study of epizootic diseases, to sit in Paris, was made on the initiative of the French Minister of Agriculture (M. RICARD) in October 1920. Forty-three States responded to the invitation, including Germany, United States of America, Argentina, Austria, Belgium, Bolivia, Brazil, Bulgaria, Chili, Denmark, Republic of Dominica, Equador, Spain, Finland, Great Britain, Ireland, Canada, South Africa, Australia, India, New Zealand, Greece, Haiti, Hungary, Italy, Japan, Luxemburg, Morocco, Monaco, Nicaragua, Norway, Paraguay, Holland, Peru, Poland, Portugal, Roumania, the Kingdom of the Serbs, Croats and Slovenes, Sweden, Switzerland, Czecho-Slovakia, Tunisia, and Venezuela.

The agenda was as follows :—

(I)

1. Examination of the sanitary situation, especially in so far as it concerns rinderpest, foot-and-mouth disease, and dourine.
2. Exchange of information concerning contagious diseases. Publication of Sanitary Bulletins.
3. Eventual creation of a "Permanent International Bureau of Epizootics."

(II)

Sanitary measures applicable in the countries of export for dealing with exported animals : Quarantine Stations for animals destined for exportation.

At the first sitting HUTYRA placed on the table his report to the International Veterinary Congress at Berne, the conclusions of which had been unanimously approved. Short notes were prepared by the French delegation relative to rinderpest, foot-and-mouth disease, and dourine to serve as a basis for discussion. These notes were read by LECLAINCHE. In the discussion upon rinderpest attention was paid particularly to the susceptibility of the pig to the virus and the rôle of animals of this species in the transmission of the disease.

The Conference also dealt with the virulence of fresh animal products, notably meat; the conclusions drawn by the French Delegation were remitted to a special Committee.

In the discussion upon the note relative to foot-and-mouth disease, attention was paid to the value of sanitary police measures and also to the conditions of animal traffic between affected countries. The discussion was summarized and the conclusions referred again to a Committee. In the discussion upon dourine the history of the disease in Italy in recent times and the efficacy of treatment in combating this disease were dwelt upon. The conclusions proposed by the French Delegation were remitted to a Committee.

Three Committees were appointed with instructions, respectively: (1) To examine the means of grouping together all information upon sanitary problems and to express its views upon the utility of creating an International Sanitary Bulletin; (2) To study measures relative to exportation having regard to living animals and animal products; (3) To report upon the eventual creation of a permanent international bureau for combating epizootics.

The resolutions passed by the Conference, after receiving the reports of the Committees on the various matters outlined above, were as follows:—

I.—Rinderpest.

1. On account of the uncertainty of our knowledge upon the resistance of animals and the variations in susceptibility due to difference in species and breed, or to individual circumstances, the introduction of ruminants and of pigs from regions which are not certainly free from infection constitutes a source of danger which justifies the enactment of prohibitory measures.

2. The prosecution of experimental researches is indicated upon the modes of infection, the susceptibility of the various kinds of animals, the virulence of different animal products, the dangers which may result from the transportation of virus by means of animals which have recovered or are healthy in appearance, and in a general way upon all that touches upon the experimental study of rinderpest.

Further, as the result of a discussion upon some supplemental proposals raised by Hutyra and considered by the Rinderpest Committee, the Conference recommended that the struggle against rinderpest should be based upon the following fundamental rules:—

(1) Telegraphic information to be conveyed immediately to neighbouring countries as soon as new centres of the disease appear in regions up to that time free from it.

(2) The principle to be adopted should be compulsory slaughter of affected animals and clinical suspects, and also, to the widest extent possible, animals that have been exposed to infection, although they may be healthy in appearance, with immediate and full compensation.

(3) The use of a product which is virulent, or capable of recovering its virulence, for purposes of immunization in countries that are free from the disease to be forbidden.

(4) The industrial production of sera and vaccines against rinderpest to be forbidden in countries free from the disease, exception being made in the case of scientific establishments which are State controlled.

II.—Foot-and-Mouth Disease.

1. The active prosecution of researches on the study of foot-and-mouth disease is indicated, especially with a view to the achievement of scientific methods of treatment and practical means of immunizing animals exposed to infection.

2. Without interfering in any way with the independence of investigators, co-ordination among the various laboratories that are devoted to the study of foot-and-mouth disease is desirable, and the results obtained (whether they be only negative or partial) in the laboratory and in practice should be immediately published and collated.

III.—Dourine.

1. A careful and prolonged supervision should be exercised in all countries with a view to the ultimate determination of existing centres of the disease. Researches concerning treatment, practical methods of diagnosis, and persistence of the virus in animals that have apparently recovered should be prosecuted and the results obtained should be published forthwith.

The following supplementary proposals brought forward by Ostertag were adopted :—

(1) In threatened areas the stallions should be registered and submitted to a monthly veterinary inspection.

(2) In these areas all mares and asses already covered or destined to be put to the stallion should be registered or submitted likewise to a monthly veterinary inspection.

IV.—Sanitary Information and Sanitary Bulletin.

1. Sanitary information to be forwarded by telegraph to all countries adhering to the Conference as soon as rinderpest appears in an area hitherto free from the disease, and upon the diagnosis of the first cases of foot-and-mouth disease in a country likewise free.

2. Periodical printed bulletins to be drawn up according to a uniform plan, compulsorily furnishing information upon the presence and spread of the following diseases : rinderpest, foot-and-mouth disease, contagious bovine pleuro-pneumonia, anthrax, sheep-pox, rabies, glanders, dourine, and swine fever.

3. This information to be given in detail in the case of each province or department invaded : (*a*) the number of parishes or farms still infected at the commencement of the period in question ; (*b*) the number of parishes and farms infected during the period under consideration, and, if possible, the number, by species, of affected animals and animals exposed to infection.

4. These bulletins to be published on the 1st and 15th of each month, and to be despatched within a period of not more than 10 days after the dates of publication, so as to reach without delay the Governments and their interested administrations or services.

V.—Measures for dealing with Exportation. Quarantine Stations.

Animals, together with dangerous animal products destined for exportation from one country to another, to be accompanied with a certificate of origin and of health, delivered under the responsibility of the exporting country by a State veterinarian or vouched for by the State.

The text of the certificate will be studied in each country and the different texts will be examined at a later Conference with a view to arriving at a formula which will be submitted for the approval of the delegates of adhering countries.

VI.—International Bureau.

The Conference passed a resolution urging the need of creating an International Office, at Paris, for combating infectious diseases of animals. This Bureau will have essentially as its object :—

(*a*) To gather together and acquaint Governments and their Sanitary Administrations with facts and documents of a general interest concerning the spread of epizootic diseases and the means employed for combating them.

(*b*) To stimulate and co-ordinate all kinds of researches and experiments bearing upon the pathology or prophylaxis of every infectious disease of animals, the execution of which calls for international collaboration.

(*c*) To study suggested projects of international agreements relative to the sanitary police of animals and to place at the disposal of Governments signatory to these agreements means of controlling their execution.

The Office to be placed under the authority of a Committee composed of technical delegates from the various States, and these delegates will hold meetings periodically and at least once a year. With the approval of the Governments adhering to the International Convention held at Rome on December 9th 1907, it will be attached to the International Office of Public Hygiene.

It is the desire of the Conference that the French Government should prepare a projected convention on the basis of the resolutions adopted, communicate its propositions to all countries represented at the Conference, and invite interested Governments to nominate plenipotentiaries empowered with the signature of the State with the shortest delay possible.

The Conference authorized MM. Luthario, Pottevin and Leclainche to place themselves at the disposal of the qualified French authorities in order to provide them with facilities for the establishment of this projected convention.